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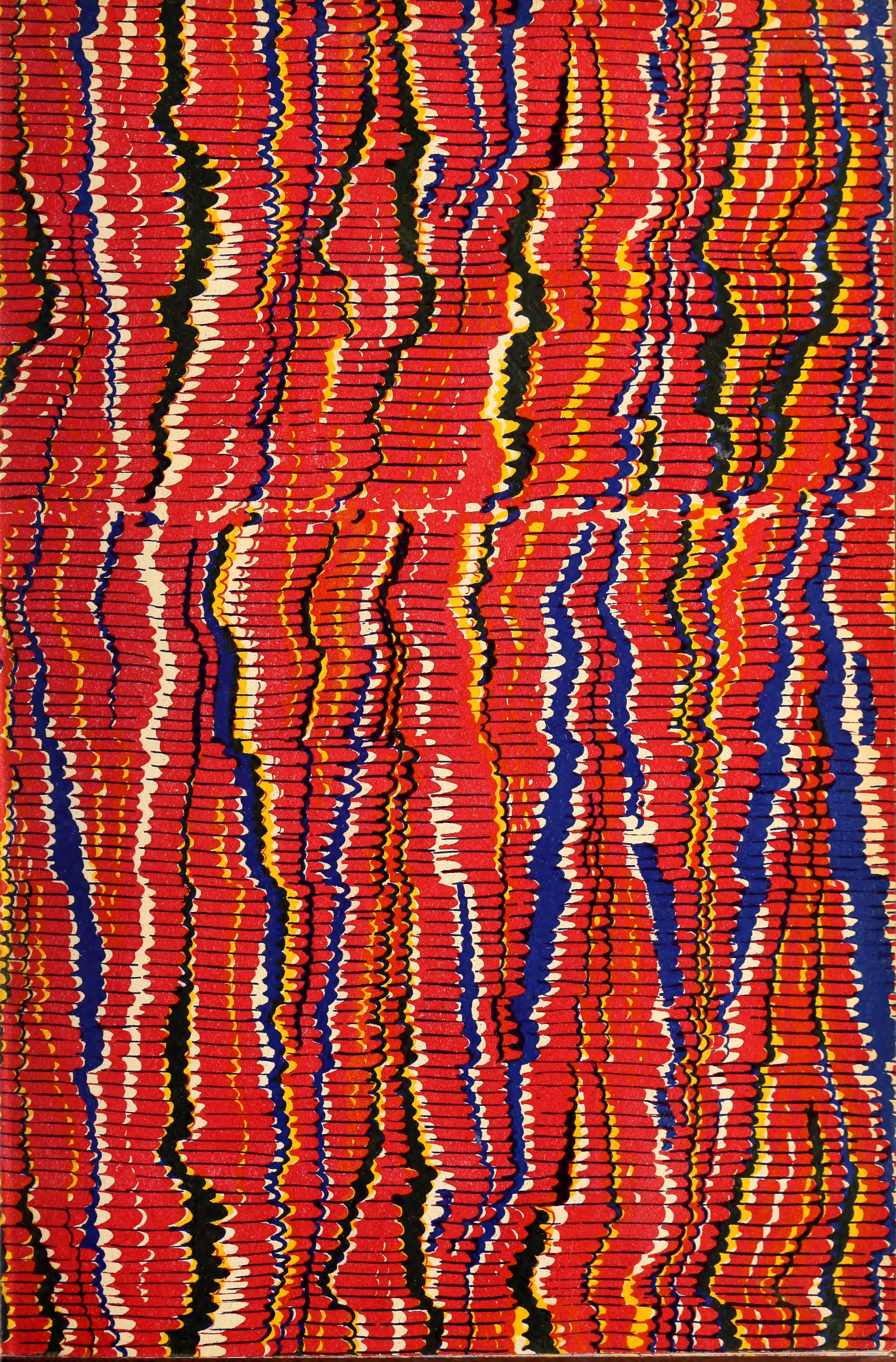

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A QUARTERLY JOURNAL OF ECONOMIC AND
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EDITED BY WILLARD N. CLUTE

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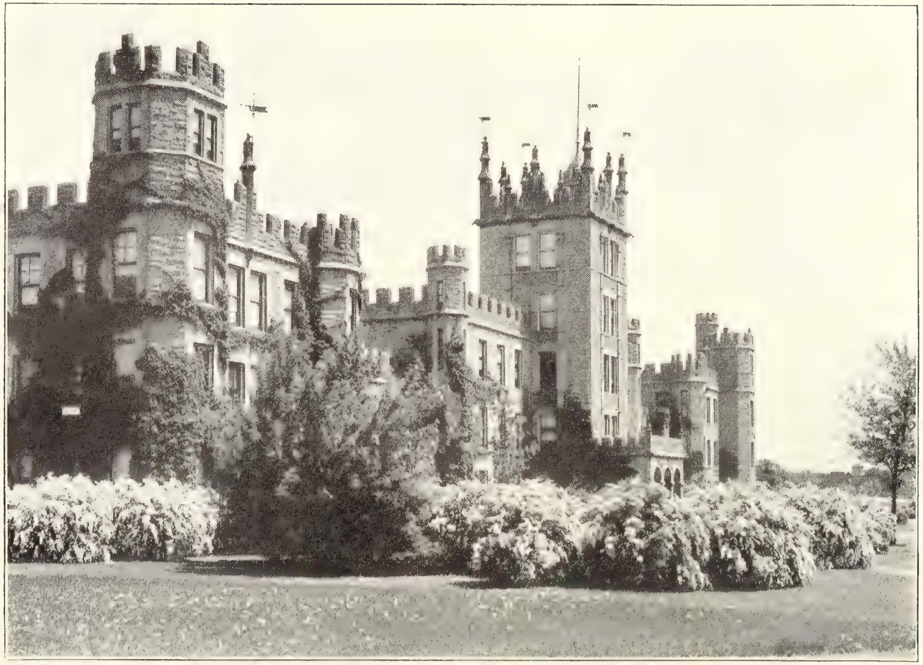


NORMAL SCHOOL OF NORTHERN ILLINOIS.

THE AMERICAN BOTANIST

VOL. XXI JOLIET, ILL., FEBRUARY, 1915 No. 1

The birch tree throws a scarf of green
Around her, silvery white,
Woven of little polished leaves
All delicate and bright,
It sways with every passing breeze
And shimmers in the light.

—E. B. Howard.

AN ILLINOIS SCHOOL CAMPUS

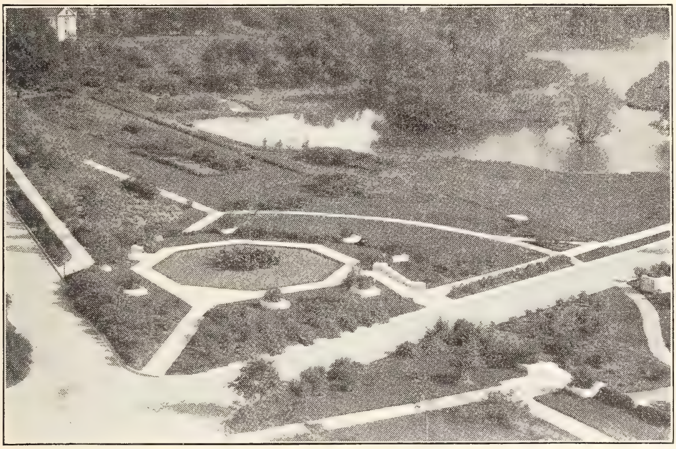
By Frank Keffer Balthis.

THE Normal School of Northern Illinois was established in the year 1889 at DeKalb. Its business, as is usual with schools of like character, is to instruct students in the mysteries of teaching, and to prepare them for that profession. Starting with a small number the school has grown until in recent years it graduates more than one hundred at each commencement. The total enrollment at present is 480 of which 430 are of the fairer sex. It may be of interest to the readers of a magazine which appeals to the aesthetic to know something of the environment under which these students live.

DeKalb is an enterprising city of 10,000 inhabitants. Its close proximity—fifty-eight miles—to the City of Chicago enables the people to enjoy practically all of the advantages which a large city affords. The people are up-to-date. They become familiar with the best in art and the drama, and are in a position to cultivate and put into their daily life those things that make life worth while. The fine parks and conservatories, great museums of various kinds of the larger city give the country folk an insight into the finer things, and instill within their hearts a desire for the same. They profit from the experience, and bring to their own fireside lessons for their friends.

The campus of the Northern Illinois State Normal School is located about one mile due west of the center of town on the Lincoln Highway. It comprises sixty-seven acres of diversified land which was donated to the state by Mr. Joseph Glidden, the renowned barb wire inventor. The buildings stand on the highest point in the northwest corner of the grounds, facing south, beyond which is a beautiful grove of native trees and shrubs. The main building is one of the best in the United States. The style of architecture resembles one of those ancient and picturesque castles with battlements towering from fifty to one hundred and thirty-five feet high. The front is faced with white stone over which grows, luxuriantly, *Ampelopsis Englemanni* and *A. Veitchii.*

In 1906 the transformation, or beautification, of the campus began. Prior to that time no attempt had been made to change the natural contour of the grounds, but through the instrumentality of a sympathetic member of the state legislature funds were secured for beginning the present scheme. An expert landscape architect, Mr. Walter Burley Griffin, of Chicago, later the winner in the international contest for supplying plans for the new capitol site of Australia, was given the commission. Upon Mr. Griffin's first visit to the site he found that the foundation of the building was not, in his opinion, of sufficient strength. He therefore conceived the idea of offering some support by building a series of terraces, which also afforded opportunity for formal planting. The large terraces, which support the upper plateau, are eight feet high and extend 384 feet along the front of the building, 112 feet from it, and 384 feet along the east side. The smaller terraces, which support the lower plateau, extend 448 feet to the Kiswaukee River, and are 160 feet wide. At the southeast corner a large octogon harmonizes with the octogonal battlements of the building, and hides the incongruity made manifest by the convergence of two driveways approaching the building at right angles.



A glimpse of the formal planting.

Both the upper and lower plateaus are utilized for formal and natural styles of gardening combined, but no abrupt or startling transition from one to the other style is discernable. In front of the main building shrub beds are laid out in the form of a panel garden and the selection of plants is such that a pleasing effect is secured for Commencement in June. Each bed is forty feet long. It may be of interest to note the choice of varieties. Chief among these is *Rosa rugosa* which is seldom out of flower, and never without beauty. *Rosa multiflora* furnishes myriads of bloom, and is followed immediately by

Philadelphus avalanche. Deutzia Lemoinei, with its upright habit, is a dependable bloomer. Later comes *Philadelphus pubescens* and *P. Zeyeri. Stephanandra flexuosus* flowers occasionally but is always attractive when in leaf. In the corners of the buildings such varieties as *Lonicera tatarica L. Ruprechtiana,* and *Symphoricarpus racemosus* furnish an abundance of flower and fruit. The octagon is clothed with the beautiful *Spiraea Van Houttei, Forsythia suspensa, Rosa multiflora,* and *Lycium halamifolium.* On either side of the roadway the banks near the building are covered with evergreen rose (*Rosa Wichariana*) *Rhus glabra laciniata, Lonicera Japonica, Lycium halamifolium* and occasional groups of *Berberis ilicifolia.*

The high terraces are crowned with a hedge of *Thuya Ellwangeriana,* and at their base are long beds of shrubbery to hide the bare surfaces. These beds contain such beautiful and hardy varieties as the *Tamarix Gallicia, T. Odessana, Lonicera Morrowi, Amorpha fruticosa, Berberis vulgaris, Ribes aureum, Lonicera Tatarica, Rosa humilis, Aralia spinosa, Philadelphus coronarius, Ligustrum vulgare, Sambucus Canadensis, Weigelia* or *Diervilla Eva Rathke,* etc. At the base of the high terrace a panel garden 384 feet long and 20 feet wide is planted solidly with seventy-five or more varieties of perennial flowering plants. Across the gravel walk from the perennial garden, and running its full length, is a border of low-growing shrubs, such as *Spiraea prunifolia, Spiraea Thunbergii, Eleagnus longipes, Berberis Thunbergii, Lonicera spinosa* or *Albertii, Rosa rugosa alba, Hypericum prolificum, Prunus pumila, Potentilla fruticosa,* and between the shrubs along the walk are colonies of hardy bulbs and perennials.

The perennial bed is probably the most popular place on the campus. Here are found large masses of *Chrysanthemun leucanthemum,* Kelway's *Gaillardias* and *Delphiniums, Althaeas, Campanula, Sedum, Phlox paniculata* and *P. subulata,* *Helianthus* in variety, *Anthemis tinctoria, Iris pumila* and varieties of *Iris Germanica, Achillea* "The Pearl", many kinds of *Aquilegia, Paeonias, Papaver orientale, Lilium Tigrinum, L. umbellatum, Lychnis Chalcedonica Hesperis matronalis, Yucca filamentosa,* and many others. Whenever vacancies occur, and they will occur in all gardens, annual flowering plants are sown in their places. In addition to these are hardy bulbs, such as parrot tulip, darwin tulip, and the common *Gesneriana* types. *Narcissus poeticus ornatus* is planted in numbers because it is so perfectly hardy and attractive for cut flowers. No attempt has been made to plant according to a color scheme because the principal purpose of the garden is to furnish material for study.

The lower plateau is laid out in a series of sunken beds. These are arranged on both sides of the east drive, and are planted with perennials. One bed is planted with *Paeonia festiva maxima;* another with *Paeonia Mad. de Vatry* and throughout both are hundreds of crocuses and Lilies. Still another bed is planted with *Clematis Flammula, C. paniculata,* and *C. Virginiana.* At the top of each sunken bed is a hedge of low-growing plants. The kinds used for this purpose are *Kerria Japonica, Philadelphus microphyllus,* and *Spiraea Bumaldi* Anthony Waterer. The top of the lower terraces are lined with *Berberis Thunbergii* and *Pyrus Japonica.* It may be of interest to note that it was found necessary to send to France for the *Philadelphus.* Think of being obliged to send to a foreign country for a native plant! It would doubtless be quite easy to find hundreds of varieties of foreign importations in this country at any large nursery, when it should be the reverse.

Along the river to the north is a very fine grove of *Crataegus.* The trees, for the most part, are about twenty feet high, and include such superb native species as *C. Crus-galli, C. mollis, C. tomentosa* and several intermediate varieties or hybrids. In spring the grove is a sight to behold and later on the fruits are nearly as attractive. Normal Lake contains about eight acres and is fed by a brook which flows along the north side of the large grove. The outlet consists of a series of artificial pools which provide for a five foot fall into the Kiswaukee River. The lake attracts considerable attention at all times. It permits of boating in the summer and ice sports in the winter. It also contains much material for study, such as *Sagittaria, Potanogetum, Ranunculus, Equisetum, Caltha, Typha,* and various Thallophytes. While the planting is only partially completed along the banks much has been done. Hundreds of moisture-loving plants, such as *Cephalanthus occidentalis, Viburnum Opulus, Rosa Carolina, Viburnum Lentago, V. prunifolia, V. alnifolia, Salix vitellina aurea* and *Britzensis, Alnus incana, Alnus viridis,* and *Sorbus melanocarpa* have been planted in masses around the borders. Many hardy water lilies are utilized and furnish a charm which is only found in the aquatic family. A long vista from the office over the octogon and across the lake will be much enhanced when the plantations reach maturity.

The native grove along the front of the grounds is a favorite with the nature study classes for here one may find a large and varied collection of plants. Among the trees are *Celtis occidentalis, Quercus rubra, Q. alba, Carya ovata, Juglans nigra, Tilia Americana, Ulmus Americana, Ulmus flava, Fraxinus Americana, Prunus serotina, Prunus Virginiana, Crataegus, Prunus Americana, Pyrus coronaria,* and others of equal importance as representatives of our own flora. Beneath the trees shrubs grow wild as no attempt is made to "beautify" the grove by cutting out the undergrowth. One may find the *Amelanchier, Viburnum prunifolia, Dirca palustris, Corylus Americana, Rhus glabra, Ribes Cynosbati,* etc., and here and there around the borders are masses of *Rhamnus Cathertica, Crataegus coccinea, Ligustrum vulgare, Euonymus atropur-*

pureus, Viburnum dentatum, etc. Throughout the grove are great colonies of wild flowers. Here are found *Trillium sessile, Viola cucullata, Dicentra cucullaria, Phlox divaricata, Anemone, Claytonia virginica, Erythronium Americanum, Smilacina racemosa, Dodecatheon Meadia, Helianthus, Solidago, Rudbeckia, Erigeron canadensis,* various Asters, and others of equal interest. A meandering path is one of the charming promanades; here the tired student seeks recreation and quietude after the strenuous day; here also the town people spend many happy hours for the grounds are always open to the public. Looking toward the building the towers may be seen as if veiled with foliage. Surely, the outlook, the environment, is conducive of healthy minds and bodies.

A series of artificial pools.

In the rear of the main building is the plant house. It is utilized by all departments of the school, but more especially by the biological department and by the pupils of the training school. Aside from the uses made in experiments a fair collection of economic plants are grown. Among these may be mentioned a fruiting banana, the date palm, vanilla bean, ginger, coffee, panama hat plant, mahogany, tapioca, rubber plant, sisal hemp, weevil plant, allspice, cinnamon, southern moss and sensitive plant. In addition to these a few orchids and other epiphytes, a number of cactuses and other succulents, palms, and ordinary bedding plants are grown. A conservatory should be as much a necessity as any other department in all schools if for no other reason than to enable the students to become familiar with a few of the wonders of the vegetable kingdom. How interesting, and profitable, would the student find a good representative collection of economic plants.

Adjoining the plant house on the rear is the school garden. It contains about an acre and a half, and, in connection with the plant house is productive of many profitable hours. Individual beds are given to a number of the older pupils, some are used by classes, and others are reserved for experiments with field crops. The school garden, as in all gardens of a similar nature, is used entirely as the out-of-door laboratory. The smallest child wants to work "in the dirt," the larger one wants to learn what can be gotten out of it. The work in the school garden has its influence on the home as may be exemplified on almost any holiday when the numerous parents are brought by the children to "help pick the corn," "pull radishes," or otherwise to lend a hand.

Is such an environment worth while? Is it better than barren playgrounds without any embellishment whatever? What must be the thought which comes to the student upon entering such a place? Will he not remember when he leaves school and carry away impressions which will be effective later on? We know he will.

THE WINTER FLORA OF A MOUNTAIN TOP

BY WALTER H. BUSWELL.

BEING in the vicinity of Chocorua Mountain in eastern New Hampshire early in December, we planned a walk to the top of this, one of the most interesting mountain peaks in New England. Starting about nine o'clock in the morning we climbed along a rocky but well marked trail to the Peak House which stands on a long narrow ridge at the foot of the real peak. This latter is a huge rocky dome towering about 600 feet higher. Vegetation of any size stops at about the elevation of the peak house. It consists mostly of scrubby spruce, fir, mountain alder, white birch, red maple, striped maple, mountain ash, viburnum, rhodora, sheep laurel, mountain cranberry, black crowberry, two or three species of willow and several species of blueberry.

The only passible way to the top of the dome winds around the west side along almost perpendicular cliffs, icy in places at this season. Then from a small level spot on the west side, where a small signal station is located, one must pick his way upward over the steep smooth rock where a slip would be disastrous. On the top of the dome we found a greater variety of plant growth than one would expect to find on a point of solid rock a few rods square, 3600 feet high. A plant that can gain a foothold and continue to live, year after year, in the few small crevices in the rocks, swept by the fierce cold winds of winter and with absolutely no protection from the sun on the hottest days of summer may well be placed in the hardy class.

A slight deposit of rotted stone seems to be the only material the plants have to root in, and it is a wonder that even this is not washed off by some of the hardest storms. There must be days and possibly weeks at a time when there is no more moisture on this top than there would be on a tin roof, yet we find here strong healthy plants, many of them evergreen, producing flowers and fruit in a situation apparently unsuited to any form of plant life. Pygmy spruces one or two feet high, but probably as old as many of the large spruces farther down the mountain, are scattered over the top and down the sides wherever there is a chance for a foothold. A few other dwarf plants which might have been trees under more favorable conditions occur also, among them white birch, red maple, and mountain ash. It is doubtful if these trees would live as long in this situation as the spruces.

There were several large beds of mountain cranberry on the summit with an abundance of fresh, finely flavored fruit, to us much more palatable uncooked than is the large market cranberry, though this is contrary to the opinions of many writers. One calls them "bitter acid." The fruit as we found it here had not a trace of bitter. Cold and frost may be necessary to give them their full flavor. I have never eaten them before freezing weather. Mr. J. M. Macoun says: "The fruit of the mountain cranberry is considered of no value in the warmer parts of Canada, but in the cold, rocky woods of the North, along the shores of Hudson Bay and the Arctic Ocean it seems to gain in size and flavor out of the very conditions that dwarf and destroy its less hardy competitors, for there it is acid and not acrid and pronounced to be the equal, by those who have eaten it there, of the cranberry. May not something be due to the appetite of the eater in that northern clime?" The berries are often eaten by birds in preference to other food and they form a favorite food for the black and polar bears.

Scattered over the summit, wherever nothing else would grow, were many small plants with green, trifoliate leaves notched on the broad tips. These were specimens of *Potentilla frigida*. In "Legends of Laconia" after the death of Chocorua on the mountain top, Ronsel O'Donnegan said to Captain Grovenor: "After that I jist stooped down and broke me a bit of the shamrock ye see here and hild it out to the ould chief as a token that for one Ronsel O'Donnegan bore no ill to him." This was the same little shamrock that may be found today on Chocorua's rocky top.

In all we found eighteen different species in the small space at the summit, more than could be found in many spots of this size in our New England fields and pastures. A visit to the peak is well worth while at any time of the year, but it is especially so in winter when we can better understand what these hardy little plants have to endure. On the trip we also found some old acquaintances among the plants in one of the last places we would expect to find them. On the sides of the dome, where it was far from moist or swampy, we found many plants of the meadow sweet (*Spiraea salicifolia*) and near the base of the dome, not far from the Peak House, we saw hundreds of *Rhodoras* with an abundance of seed pods. These plants I have usually found growing not far from lakes or moist ground in northern forests and often in bogs. They must be very showy and beautiful here when in full bloom and we left with the hope that some day we might see them at that time.

A GARDEN OF ASSOCIATIONS

By Charles Francis Saunders.

IF you are a sincere lover of plant life, your garden is the home of personal friends in whose family history, present struggles to get on in the world, and prospects of success or failure, you have something of the same sympathetic interest as in the lot of your human fellows. Particularly is this so of the perennial growths, which (unlike the annuals whose stay is temporary) abide and take pot luck with you season after season, through summer and through winter weather. However fickler acquaintances may flout you, these sturdy friends present to you always with recurring springs, the same cheery faces of encouragement, and, jogging down the years together, you grow old in one another's company. So in setting out a garden, the choice of the perennials is a subject for serious judgment, that these attendants on your travel through life shall be of such dignity and significance as will wear well as companions—that there shall be more to them than just good looks; in other words, that they shall be plants that stand for something.

Personally I find particular pleasure in plants with a history. By this I mean either that the special individual has some story to tell or possesses some association which makes it of interest; or that it is of a race that has had a part in the history of the world beyond my garden fence. Of the first sort may be instanced plants from an ancestral garden which are thus connected with your own or your family's past; or those raised from seeds or cuttings taken in some noted place, or presented by a valued friend. Of the second kind are plants whose associations are generic, like the daffodil and the English daisy with all their wealth of poetic allusion from Chaucer down; or the stately hemp plant whose fibre supplied cordage to the argosies of ancient Rome and Tyre, and whose narcotic juice was the basis of the hashish brew with which the Old Man of the Mountain enslaved his Assassins. Many plants have a really extensive literature, and one who has never looked into the matter will be surprised to find how romantic a role even such homely subjects as the onion or the common parsley have played in the drama of man's development. Works like De Candolle's "Origin of Cultivated Plants," Britten and Holland's "Dictionary of Plant Names," Prior's "Popular Names of British Plants," and Thistleton Dyer's "The Folk Lore of Plants"—to mention a few among many—are excellent introductions to the recorded history of numerous perennials which either are garden favorites already, or might well be.

To put the matter in a concrete way I may cite a little garden I know which embodies the general idea here touched upon. It is in Southern California—a region where soil and climate are, to be sure, exceptionally hospitable to introduced plants—but the plan of it, *mutatis mutandis,* may readily be followed in almost any part of our country. Here along with the conventional oranges and roses, a thrifty young carob-tree is growing—the Syrian "St. John's Bread," whose brown, bean-like pods are at times seen on our fruiter's stalls, and the husks of which were doubtless the fare of the Prodigal Son of the Scripture narrative. Here, too, is an Italian stone-pine raised from seed sent by a friend from the famous grove of Ravenna associated with Dante; and companioning it, one of our own nut-pines or pinons, interesting as long a principal source of food to the vanishing aborigines of our Southwest. There is also the wild shrub *Cowania,* or Mexican cliff rose, cherished as an individual because raised from seed gathered on the rim of the Grand Canon in Arizona, and so linked with the memory of a certain noteworthy outing, and interesting in a more general way because the plant's shredded bark has been used from time immemorial by Navajo Indian mothers for padding the cradles of their babies. In a sunny corner there flourishes a plant of the classic acanthus, whose leaf thousands of years ago suggested the design of the Corinthian capital; there is the rosemary of Shakespeare, the proverbial herb of remembrance; and there is true myrtle, sacred to love since history began, and still twined into wreaths to crown the heads of Bavarian brides. The Franciscan Missions, California's most famous antiquities, are represented in this quiet garden of memories, by a white oleander raised from a slip obtained in the old padres' garden of San Juan Capistrano, and a tamarisk from the less frequented Mission of San Antonio de Padua.

There are many more that might be noted, but this much will perhaps serve to illustrate the plan. It will be observed that regard has been had to beauty as well as to historic import or personal association. From time to time additions are made to this notable fellowship, and as thinning out becomes needful —for the plot is only about 85x100 feet, and the temptation to set young plants too close together is the universal failing of amateur gardeners—the elimination is of the more conventional.

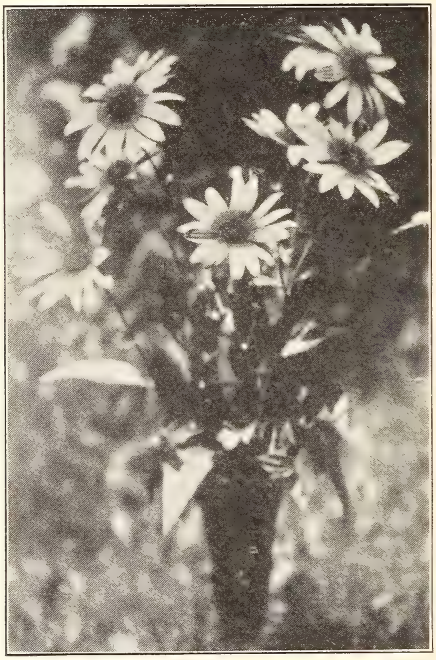
INSECTS AND THE COLOR OF FLOWERS

By Willard N. Clute.

THOSE who are interested in the pollination of flowers by insects are often puzzled to account for the behavior of their subjects, though doubtless much of their perplexity is due to their attempts to reason out insect conduct according to rules drawn from human conduct. If an insect happens to visit a hidden flower which to the human sense of smell is odorless, we at once wonder how the insect was attracted to it, quite forgetting that though odorless to us it may be filled with fragrance so far as the insect is concerned. It is beginning to be pretty well known that many flowers give off odors that our sluggish sense of smell cannot perceive. Possibly all flowers are odorous to the insects.

Something akin to this also exists with regard to the sense of sight. The human eye has a very limited range and perceives only seven colors. Nobody knows what color the rays below the red or beyond the violet end of the spectrum are for no human eye can translate these rays into color and yet the insect eye may very likely be able to do so. Ants appear able to see in ultra-violet light and from the fact that several flowers have been discovered which reflect these rays it is probable that other insects may perceive them also.

Botanists often discuss the preferences of insects for flowers of a certain color, but who knows whether the flowers appear to insects as they do to us? As a matter of fact, they probably do not. On this point an interesting light is shed by a common wild sunflower (*Helianthus laetiflorus*), shown in the accompanying illustration. To the ordinary eye, the ray-flowers of this plant are of a uniform yellow color and the disk-flowers are but slightly darker, but when the camera perceives them it tells a different story, for the disk flowers come out quite dark in the print and there is a dusky ring surrounding the disk produced by the base of the rays. It is very apparent, therefore, that what appears to us as a clear yellow flower head is not so to the camera and very possibly may not be so to the insect. And having once been shown how easily the eye may be deceived as to flower color how dare we assert with confidence, hereafter, that flowers appearing of a certain color to us appear of the same color to insects?



The dusky ring surrounding the disk.

Several flowers are now known which affect the photographic plate as those of the sunflower do, but whether this is due to reflections of ultra-violet light or to some other cause does not seem to be known at present. The facts at hand, however, may serve to show how far we are yet from a complete understanding of the relations of flowers to insects and to render us somewhat cautious in interpreting insect behavior in terms of our own experience.

THE SPINULOSE SHIELD FERN

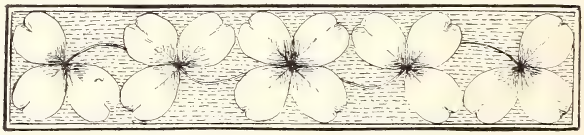
By Adella Prescott.

ONE of the things that impresses the thoughtful observer is the fundamental good sense of Nature in spite of her many freaks and whimsies, and nowhere does this good sense appear to better advantage than in the lavish manner with which she flings beauty broadcast over the land while carefully reserving the adjective "rare" for plants that frequently have little other claim to distinction. Especially is this true of ferns, for while the adder's tongue and the small Botrychiums among our rarest ferns have neither height nor beauty to commend them, the spinulose shield fern, which is very plentiful over a wide range, is one of our most beautiful species.

This fern, *Nephrodium spinulosum*, with one or both of its varieties may be found in almost any bit of woodland where the soil is deep and moist. Perhaps it would be more accurate to say that its varieties may be so found for both of them seem to be much more common than the type, which is rather rare in this locality (central New York). But the varieties shade into each other so imperceptibly that it is not easy to put each specimen in its proper place. This is more particularly the case with true *spinulosum* and the variety *intermedium* for their differences are often so slight that it would puzzle even an expert to give them their correct labels. And why the variety that, generally speaking, is longer, narrower and more finely cut than any of the others should be called "intermedium" is not for me to say. *Dilatatum* with its broadly ovate fronds is much more distinctive and can generally be placed without difficulty.

This species may be distinguished from most of our other ferns by its finely divided foliage, only two or three others equalling it in this respect. The blade is nearly three times pinnate but the cutting varies greatly and the secondary pinnules are not always completely pinnate. The pinnules on the lower side of the pinnae are often elongated, especially in the lowest pair, and this characteristic is very noticeable in *dilatatum*. The sori are rather small and are borne on the backs of ordinary fronds. All have evergreen fronds which are much used by florists at the present time for winter greenery.

This group is among those most desirable for the fern garden as all the varieties are easily transplanted and retain their beauty throughout the season. In the woods the finest specimens are often found nestled close to a decaying moss-covered stump or a weatherbeaten rock and such environment enhances their attractiveness, but they are charming in any shady nook and those who wish to keep a bit of woodland beauty close at hand cannot do better than to bring a group of spinulose ferns (with their attendant fairies) to share their gardens and their hearts.



A VISIT TO THE SARATOGA BATTLEFIELD

By Stewart H. Burnham.

DURING my residence in Albany, N. Y., three trips were made to the Saratoga battlefield. The easiest and quickest way to reach this historic spot, from the south, is to take the Delaware & Hudson train to Mechanicsville; and there change to the Hudson Valley trolley up the river, getting off the car either at Bemus Heights or Wilbur's Basin and ascending the roads a mile or two, westward from the old Champlain canal. Scattered over the battlefield and along the roads are many granite tablets marking historic spots; and from almost every portion of the field, a fine view of Willard Mountain, 6 miles away across the river, in Easton, may be had; while to the southeast forty miles distant, Greylock, King of the Berkshires, rears his head.

Along the road at Bemus Heights, the mottled bergamot (*Mentha gentilis*) grows; and about an old house bottom, the matrimony vine (*Lycium halimifolium*), which has only been recorded twice elsewhere in the Lake George Flora, in similar situations was found. Ascending the clayey road at Bemus Heights, one passes the tablet marking the site of the old Bemus tavern. Near by, in the fields, a little of the whorled milkwort (*Polygala verticillata*) grows at about its northern limit in the Hudson valley; with the slender gerardia (*Gerardia tenuifolia*), which previously has only been collected in the flora, across the river at Hudson Falls, several miles to the north.

Between the canal and the battlefield are numerous deep ravines, mostly belonging to the drainage of Mill Creek; but a mile back on the field, the land becomes more level and slightly rolling. Mill Creek proper flows through "The great ravine" where "the battle raged back and forth on Sept. 19 and Oct. 7, 1777." This ravine is not over fifteen to twenty feet deep. A medium sized white pine stands on its pastured side; whose parent probably shaded the ravine when it was the scene of bloody conflict. Rue spleenwort (*Asplenium Trichomanes*), marginal shield fern (*Aspidium marginale*), the polypody (*Polypodium vulgare*) and a few lichens and mosses were found here on the Hudson river shale.

On the hillsides in the southern part of the battlefield within the bounds of the American camp and along the descending streams, the creeping thyme (*Thymus Serpyllum*) grows so abundantly in places that it becomes a weed. This is the only known station for it in the Lake George Flora where it persists and spreads. Could it have been brought here in 1777? The old story current in these parts is that Gen. Burgoyne on his march southward to Saratoga, brought down the Canada thistle (*Cirsium arvense*) in his hay. The common vetch or tare (*Vicia sativa*), a rare plant in the flora, was found along the road near the new Freeman farm, and on an open wooded hilltop along the eastern margin of the battlefield, the rare *Atriplex patula* grew quite abundantly.

Many interesting plants grow along the partially wooded hilltops along the eastern side of the field. White pine (*Pinus Strobus*), American white birch (*Betula populifolia*), American chestnut (*Castanea sativa*), the oaks (*Quercus alba, Q. coccinea, Q. macrocarpa, Q. rubra* and *Q. velutina*), and the maples (*Acer rubrum*) and (*A. saccharum*) occur. One cannot help thinking that there is still an occasional tree standing that was a sapling when this decisive battle of the American Revolution was fought. Among the shrubs recorded were sweet-fern (*Myrica asplenifolia*), the hazels (*Corylus Ameri-*

cana and *C. rostrata*), the sassafras (*Sassafras variifolium*), witch-hazel (*Hamamelis virginiana*), smooth sumac (*Rhus glabra*), round leaved dogwood (*Cornus circinata*), privet Andromeda (*Lyonia ligustrina*), sheep laurel (*Kalmia angustifolia*), mountain azalea or swamp-apple (*Rhododendron canescens*) and sheep-berry (*Viburnum Lentago*). A few plants of the downy rattlesnake plantain (*Epipactis pubescens*), Hooker's rein-orchis (*Habenaria Hookeri*) and pinesap (*Monotropa Hypopitys*) were found associated with more common herbaceous sylvan species.

CONTRAST BETWEEN ANIMALS AND PLANTS.—Every higher animal is itself a working unit. It is one. It has a more or less definite span of life, and every part and organ contributes a certain indispensible part to the life and personality of the organism. No part is capable of propagating itself independently of the sex-organs of the animal nor is it capable of developing sex-organs of its own. If any part is removed, the animal is maimed and perhaps dies. The plant, on the contrary, has no definite or distinct autonomy. Most plants live an indefinite existence dependent very closely upon the immediate conditions in which they grow. Every part or branch of the plant lives largely for itself; it is capable of propagating and multiplying itself when removed from the parent or colony of branches of which it is a member and it develops sex-organs and other individual features of its own. If any branch is removed, the tree or plant does not necessarily suffer; in fact, the remaining branches usually profit by the removal, a fact which shows that there is a competition or struggle for existence between the different branches or elements of the plant.—*Bailey and Gilbert's "Plant Breeding."*

NOTE *and* COMMENT

Seedlings of Solomon's Seal.—The underground parts of plants have seldom been regarded as attractive objects for study—even the plant collector, until recently, discarded them when making specimens—but there are many remarkable things about them that are now being brought to light. Richard Vogt, who has been studying the seedlings of the Solomon's seal (*Polygonatum*) finds, for instance, that in this plant the seedlings though growing, do not reach the surface of the earth until the second summer. Like various other species, a certain shifting of the stored food seems necessary before the ordinary vegetative processes can be begun. When the seed begins to germinate, or sprout, the cotyledon does not come out of the seed-coat as in most plants, but remains within acting as an absorbing organ. The caulicle or beginning stem is the first part of the plant to appear and this soon develops a root two or three inches long. Later this caulicle splits open along one side and the first bud appears. This bud has only a few scales instead of leaves, the first season, and remains buried in the soil. This is quite the reverse of what occurs in ordinary plants, for in the latter the sprouting of the seed usually carries the bud up to the light in a few days. During the first summer of the young Solomon's seal, then, the reserve food in the seed is gradually transferred to the caulicle and by autumn this has formed a tuber-like body about as large as the original seed. The second season, the first leaf, a simple long-petioled organ, is sent up to the light. The food made by this leaf is transferred to the base of the petiole and produces a second tuber-like body connected with the first by a narrow neck formed by the caulicle. The third year is a repetition of the second with the formation of a third tuber which causes the underground portion to assume something of the appearance of the mature rhizome. Not until the fourth year is an aerial stem sent up and then it only sports one or two leaves. When the stem dies in autumn it leaves a scar on the new tuber formed and thereafter the underground parts are marked each successive season by the familiar circular scars which give the plant its common name. By the time the first of these scars appear, the initial tuber begins to decay and it is no longer possible to determine from an examination of the rootstalk, the exact age of the plant. It is known, however, that it is not until the tenth year, or even later, that the first flowers and fruits appear and this may give some idea of the age of well developed clumps. Considering the extreme slowness with which new plants of this species develop from seed, it is no wonder that the plant has come to depend in great measure upon its branching rhizomes for multiplication.

ABNORMAL HEPATICA FLOWERS.—Dr. J. A. Nieuwland reports in the *Midland Naturalist* that he has found several hepatica plants in which, instead of single flowers on three-bracted scapes, there were in addition to the usual flower, three others from the axils of the bracts. Several variations of this condition were noted, but the important feature in all is that more than one flower was produced on a single stalk. Another curious variation reported is that in which the outer row of colored organs was green, indicating that possibly the flower which is usually regarded as having only sepals may in reality have both calyx and corolla, colored alike. The scientists have lately seemed bent on fitting this well known flower with two sets of floral organs. A short time ago, it was noted in this magazine that evidence had been found to support the view that the green bracts were in the nature of sepals. As a matter of fact the hepatica belongs to a comparatively primitive family of plants in which the number and arrangement of the floral parts are by no means firmly fixed and in which, therefore, variations from the exact flower formulas of other families are to be expected.

EVOLUTION AND LEAF FORM.—Even the botanizer is usually well informed as to differences in leaf venation, but it may never have occurred to him to inquire how the various types came to be and how they are related to one another. E. W. Sinnott and I. W. Bailey, after a study of the vegetation of the world, have come to the conclusion that the leaves of primitive plants were palmately veined and that the pinnately branched, lobed and veined leaves so numerous at present are modified forms of the earlier type. In many of our plants with normally pinnately veined leaves, we may find extra large leaves reverting to the primitive character in the matter of veining or the base may be palmately veined and the apex pinnate. By the lengthening of a palmately veined leaf the pinnate form could easily have been brought about. There are also numerous oblong or narrow leaves like those of the common plantain in which the veining is essentially palmate though the shape of the leaf does not indicate it and the veins, instead of spreading out are all brought together at the tip. Palmately veined leaves, of this type, however, are supposed to have given rise to the parallel veined leaves of monocots. It is curious to note in this connection that the cotyledons of many dicotyledonous plants have a system of veining that is essentially like that of the monocots. At present there are few tropical species with palmately veined leaves. Most of those still left to us are found in temperate regions. They are quite numerous in the rose and saxifrage families but even in these families, the tropical species are almost certain to be pinnately veined. From considerations of these peculiarities of leaf veining, it is often assumed that the earliest plants were woody and that herbs have originated from such ancestors.

Heat Generated by Plants.—Plants are not so warm as animals for the reason that their bodily processes do not proceed so rapidly. In nature, however, there is rarely a manifestation of energy without the evolution of heat and plants are no exception to this rule. In plant parts that are rapidly developing, respiration is accelerated and a corresponding rise in temperature occurs. The common skunk's cabbage is often cited as an illustration of this. If one measures the temperature within the flower spathe he will find it noticeably higher than the air near by. A recent number of the *Kew Bulletin* records some measurements made on the male cones of *Encephalartos Hildebrandtii* just as they were ripening their pollen, which indicated that they were more than sixteen degrees warmer than the air. The difference is great enough to be perceptible without a thermometer. Several other plants in the cycad family, to which the species just mentioned belongs, are noted for the heat generated at flowering time. Among these are *Ceratozamia longifolia, Cycas circinalis, Macrozamia Miquelii* and *Dioon edule.* It is to the relatives of the skunk's cabbage, however, that the palm must be awarded for differences in this respect. Most of them produce their flowers in sheltering bracts or spathes and afford ideal conditions for measuring the heat. The ceriman of the tropics (*Monstera deliciosa*) familiar as a large climbing vine in northern conservatories, is reported as having shown a difference of twenty-seven degrees between its flowers and the surrounding air.

Sources of Nitrogen for Plants.—Although about four-fifths of the air is nitrogen, ordinary plants are unable to use any of it. Nitrogen, however, is an absolutely indispensible element and the efforts of the farmer in fertilizing his land is largely directed to supplying matter that contains it. For a long time it has been assumed that all the nitrogen in plants is taken in through the roots in the form of nitrates, produced from decaying animal and vegetable matter by bacteria. Recently it has been suggested that there may be other sources of nitrogen in the soil—the amino acids, for instance. In the case of the bacteria which dwell in the root tubercles—those of the Leguminosae are classic examples—the nitrogen compounds turned over to the plants are known to be of this character, and the fact that various grasses grow most vigorously when sown with clover seems to indicate that these plants, too, may not require nitrogen in the form of nitrates but secure it in other forms from the clover bacteria.

ORIGIN OF STIPULES.—In many plants the base of the petiole supports a pair of small organs called stipules. These may resemble the leaf-blade in texture, or they may be tendrils, sheaths, ligules, prickles and the like. The nature of these structures has long been a puzzle to botanists. They have been variously regarded as accessory leaves, as independent organs, as the remains of two lateral leaflets and as the remains of the leaf-sheath. A recent article in the *American Journal of Botany* suggests that stipules are really homologous with the teeth or lobes of leaves. A truly remarkable correlation has been found to exist between stipules and notched leaves as well as with multiple leaf-traces in the nodes of the stem. Most students of botany are aware that the veins of the leaf are continuous with the fibrovascular bundles of the stem. At the nodes the bundles send certain branches out to the leaves and these, seen in sections of the node, are known as leaf-traces. Many plants have a single leaf-trace for each leaf, a larger number have three leaf-traces and still others have more than three. In practically all plants with a single leaf-trace, stipules are absent and the leaves are entire; in those with more than three leaf-traces the leaves have a sheathing base, and in those with three leaf-traces most of the plants have stipules. Notched leaves and stipules seem to be related. For example, in the plants with three leaf-traces those which have entire leaves have no stipules and those whose leaves are notched or lobed almost invariably have them. The difference is often noticed in a single family in which plants with both notched and entire leaves occur. From this fact it is inferred that stipules are essentially lobes or teeth of the leaf, their greater size being due to the fact that they receive their vascular supply from the lateral leaf-traces as they emerge from the stem and therefore are perfectly supplied.

Cures for Poison Ivy.—For ivy poisoning the fishermen along parts of the coast of Massachusetts where poison ivy (*Rhus toxicodendron*) abounds, treat the poisoned parts—feet, ankles, hands, etc.—by rubbing them with crushed leaves of the fire weed (*Erechtites hieracifolia*) which also grows along the shore in some abundance. In even bad cases of poisoning a few applications have been enough to cure the patient. The same treatment cures also those poisoned by poison sumach or poison dogwood (*Rhus vernix*). I have known very uncomfortable cases of poisoning by both sumachs cured in three or four days, and made far less uncomfortable in a few hours, by the use of this plant. The leaves should be fresh each time, bruised and crushed so that their sap moistens the poisoned part freely and is allowed to dry in.—*Miss C. G. Soule, Brookline, Mass.* [It would be of interest to make a list of the plants whose juice is regarded as a specific for ivy poisoning. In some localities the juice of the touch-me-not (*Impatiens*) is valued for this purpose and in others the burdock has some repute. Judging from what is known of the poisonous principle in the sumach family it seems doubtful if any of these herbs can do more than take the attention of the patient from his troubles and cure him by mental suggestion, but there may be a reason under it all. If any of our readers know of other plants used for ivy poisoning, we would be glad to hear from them.—Ed.]

Variations in Flower Color.—Some years ago, I found on the border of Caspian Lake in Greensboro, Vermont, a pure white form of skull-cap (*Scutellaria galericulata*). The following year it appeared again from which I inferred it was not a sport. My son found more at some distance and sent it to Prof. Gray with an inquiry. Dr. Watson wrote that Prof. Gray was in England but that the specimen was not a new species. Blue and purple flowers were sometimes turned to white but were only a form of the type. Later, in Danville, Vt., my son brought a yellow orchid which was not *Habenaira ciliaris*. The finder seeing it at a distance thought it a solidago—that tone of yellow. I sent it to Dr. Britton to determine. He wrote, "I take it to be *blephariglottis*." When I referred to the description in his botany I was satisfied that though *Habenaria blephariglottis* is mentioned as pure white, Dr. Britton was right in allowing it could be yellow under certain conditions.—*Mrs. F. L. Knowlton, Medway, Mass.*

ADVENTIVE NATURE OF SOME PLANTS.—Any one interested in plant life, whether a botanist or simply a collector, must notice the adventive nature of some flowering plants. Such a one will find that here and there some flower springs into bloom, blooms perhaps several years, the seasons being favorable, and then disappears. This has been the experience of the writer. After covering the same field of investigation, some thirty miles square, for five years there was discovered one day a single bloom of *Saxifrage leucanthemifolia*. This particular saxifrage was named for the botanist Andre Michaux but whether father or son the writer is not able to ascertain. Both were sent to this country by the French government to study our North American trees with a view to introducing into France those valuable for their wood or other products. The French Revolution deprived the elder Michaux of assistance from his government and he set sail for home, losing his valuable collection in a shipwreck. Later his son spent a number of years on this soil and many of our trees were by him introduced into France. The delicate little Saxifrage in question spread and bloomed year after year for five years forming a bed some six feet in circumference. A year of drouth evidently killed them for none have been seen during these past ten years in that place. This Saxifrage is not native to the middle north but is indigeous to the Southern states. Another instance of the feature alluded to was found in the water plantain (*Alisma*). The blooms of this particular plant were pink. One summer after very heavy rains which made a slough of a low place along the highway, there were found dozens of the plants but the very next year when the water had been drained away the plantains disappeared and have never been seen since though we have always the arrow head and one or two related plants.—*Mrs. James Edwin Morris.*

Spring Flowers in Autumn.—In a certain spot along the sand ridges of the country about Hammond, Indiana, I found in full bloom on September 12, 1914, the bird's-foot violet (*Viola pedata lineariloba*) and the hoary pea (*Tephrosia Virginiana*), two species flowering ordinarily in late spring or early summer. The contrast to the same species elsewhere in the region was very striking, as there the plants had long ago bloomed and matured their seeds. I noticed that the locality in which the late flowering plants occurred had earlier in the year been subjected to a severe fire which seems to have killed all the vegetation above ground, but as there was so little humus in the barren sand the roots escaped uninjured. In this burning, I think, the cause of the late blooming is to be found. From the uninjured roots new foliage was put out and enough nutrition was thus supplied to enable the plants to flower. The hoary pea was somewhat dwarfed and the violet had rather smaller flowers than usual, otherwise the two species were flourishing very well. Of course the bird's-foot violet often produces flowers in autumn, but as the flowers were here so many to a plant and occurring as they did on all the plants noticed, there is no doubt whatever that this was not the usual condition, even if the further evidence of the hoary pea and the absence of flowers elsewhere in the region was not to be had.—*Edwin D. Hull.* [The list of spring flowering species which have been found in bloom in autumn is a long one and includes all the violets, the hepatica, trailing arbutus, bloodroot, and the rest. Various causes may account for such a phenomenon, but any check to the vegetative vigor of the plant usually accomplishes it. A tree struck by lightning, or defoliated by caterpillars, or injured by borers, may produce flowers in autumn. A severe summer drouth, or an unusually late frost killing the first crop of blossoms, or the removal of the parts above ground may cause herbaceous species to bloom a second time. No doubt a fire at the proper time would affect the plants in the same way. Among plant growers it is known that to allow plants to become "pot-bound," that is, allowing the pot to become crowded with roots, will induce flowering in plants, and so will the check caused by removing part of the root system. Spring flowering shrubs may be induced to blossom in autumn by freezing them, dipping the tops in hot water, or exposing them to the fumes of ether.—Ed.]

Phlox Blooming in Autumn.—Can some plant student tell us if it frequently happens that the blue wood phlox (*Phlox divaricata*) blooms a second time in a season? There are, of course, some of our spring flowers that do this, as for instance some species of violet, but I have never before seen the blue phlox do so. This year, however, during late October, several plants were found here bearing full-sized perfect flowers. To find these, beautiful and sweet-scented as in spring at that date was an unexpected treat.—*B. O. Wolden, Wallingford, Iowa.* [Asa Gray used to say that one may expect to find albinos of all blue and pink flowers and we may, with equal prescience add that one may expect to find any spring flower blooming again in autumn. Few of the spring flowers normally bloom in autumn, but under certain circumstances all may do so. The silvery lavender phlox (*Phlox argillacea*) which normally blooms in June produces occasional flower clusters until frost. If cut back after the first flowering, it is sure to do so.—Ed.]

Range of the Cactaceae.—Apropos of your note of inquiry regarding the range of the Cactaceae, we read as follows in Bailey's Cyclopedia of Horticulture: "Aside from certain species of *Ripsalis,* this great family containing about 1,000 known species is absolutely restricted to America. The common prickly pear (*Opuntia ficus-Indica*) has long been naturalized about the Mediterranean region and its pulpy fruit is eaten under the name of 'Indian fig'." The language of the new International Encyclopedia is very similar but not quite so definite. I doubt much if you will be able to contravene Bailey's positive statement.—*J. M. Bates, Red Cloud, Nebr.* [All the trouble comes from that one Old World genus. Those who wish to be exact might put it this way: there are native Cactaceae in the Old World but no native cacti, it being always understood that the word cacti stands as the plural of cactus and that the latter is a genus of the Cactaceae.—Ed.]

Variations in Rudbeckia.—In noting the color variations in the yellow daisy (*Rudbeckia hirta*) in these pages, we have frequently asserted that equally striking variations in other directions would be forthcoming if one cared to look for them. This statement has now been verified by A. F. Blakeslee who gave a long list of variations in this plant at a recent meeting of the Botanical Society of America, in Philadelphia. He has noted variations in the number, width, color, shape, and arrangement of the rays and in the size, shape and color of the disk, as well as many variations in the vegetative parts. The color variations in the flower were most numerous, ranging from pale straw color to deep orange with varying intensities of reddish brown at the base of the rays as reported in this magazine. The form *annulata* with lighter and darker rings about the disk were also noted. Rays were found constricted at the base, at the tip, or in the middle, and quilled rays also occurred. Most of these characters, according to the investigator, are inherited and the red splash of mahogany brown on the rays is said to be a simple Mendelian dominant.

Fleshy Fruits and Evolution.—Many a good botanist may be astonished when he reads this note to discover that fleshy fruits are almost invariably produced by woody plants, and that such herbaceous species as have fruits of this type are climbing vines. There are exceptions, to be sure—we at once call to mind baneberry, cohosh, ginseng, wild spikenard and certain nightshades among dicots, and the Solomon's seal, trillium, asparagus and clintonia among monocots—but the exceptions are rare enough to emphasize the rule. In certain families of plants conspicuous for their fleshy fruits, such as the rose family, the difference between woody and herbaceous species in this respect is striking. The terestrial herbs in this family all have dry fruits with the exception of the strawberry. Those who have observed this peculiar restriction of the fleshy fruits are of the opinion that it may throw some light on evolution. It is suggested that the trees were first on the earth and that the herbs have originated from them. The trees were disseminated by fruit eating birds, but owing to the reluctance of the birds to feeding near the ground, the herbs had to develop other means of distribution. This method of accounting for the lack of fleshy fruits among herbs seems a trifle far-fetched, but it may stand until a better one is forthcoming.

Albinism.—Albinism in plants is quite common in those which have blue or purple flowers. I recall no case of it in yellow or pink flowers. *Viola cucullata* produced one albino plant in ten, I should say, in a large patch in Atkinson, Nebraska, in the nineties. The effect was very pretty as the stools were large. *Cleome serrulata* is a common instance of albinism in Nebraska. I have never had the pleasure of testing the seed to see if they would come true. I doubt very much if they would, for I think albinos would be much more abundant if they did. The editor's explanation fails to explain when you find one albino in the midst of twenty plants closely packed in a group with their roots necessarily interlacing.—*J. M. Bates, Red Cloud, Nebr.* [Mr. Bates probably overlooked the seedsman's offerings in concluding that albinos do not come true from seeds. To take only a few common instances, there are white forms of campanulas, lupines, sweet peas, phloxes, peonies, *Physostegias, Polemoniums,* morning glories and a host of others and all these come true from seed. Albinos may occur in any flower whose color is due to colored cell sap. If the color is due to color corpuscles in the cells they are, as Mr. Bates notes, rarely if ever white. There are human albinos as well as albinos in other animals and plants and in breeding this character behaves according to Mendel's Law, which circumstance inclines one to think that albinos contain a special factor which produces albinism. Whether albinos are due to the loss of a factor or the development of a new one may still be questioned; either would account for albinos in a patch of flowers of the normal color. The reason that albinos are not more abundant is doubtless that they are abnormal and therefore always liable to be smothered out by the more vigorous normal plants.—Ed.]

Vegetables as Flowers.—The idea that vegetables are only good to eat is so fixed in the minds of most of us that we are apt to overlook the pleasure that certain of these utilitarian plants, if permitted to grow to full maturity, are capable of yielding as things of pure beauty. Lettuce, turnips and carrots, for instance, take on a new dignity, when seen crowned with their flowers, and the salsify plant produces not only a blossom of exquisite beauty, but a seed head of fairy-like delicacy of structure. It is worth while sowing a sunny border of the flower garden with a few clumps of such vegetables, for the sake of enjoying their charm in a state few people but growers of seeds ever witness.—*C. F. Saunders.* [The sea-kale, a comparatively unknown salad plant in this country, but well known abroad, is another of the garden vegetables that deserves a place among the flowers. Its creamy-white flowers are borne in profusion and make a very attractive sight.—Ed.]

Asters Turning Pink.—Several years ago wild flowers were introduced into our garden with an idea of preserving a few of these fast disappearing annuals. The wild purple asters soon appeared in various parts of the acre devoted to horticulture. Quite a bunch made its appearance under an apple tree. Last year this tree was loaded to breaking with fruit. Some was shaken off to preserve the tree but many bushels were allowed to come to full maturity. The apples are large and rather sour being excellent for cooking. The fruit ripened all through August and when the asters bloomed in September all others, save those under the apple tree were the usual rich, dark purple while those under the apple tree were a dark rose red and the blossoms were slightly larger in size than the others, some of which were only ten feet away. Did the large quantities of apples which all through July and August were left on the ground to spoil and return to the soil change the color of the asters? [It is not likely that the apples had any effect on the asters. Pink asters often occur among purple ones and are usually regarded as color sports. It may be said, however, that acids may turn blue and purple flowers pink, and it is possible that this may have been the case in this particular instance, but it is more likely that the flowers were mere sports. —Ed.]

Puffballs.—I have been told that the value of puffball spores in arresting bleeding lies in the remarkable absorptive power they possess, causing them to swell rapidly and form a pad strengthened by the well-known adhesive character of blood. I think there is no question about the fact of their usefulness. Together with much foolishness in the "old wives' Fables," there is mingled a deal of practical wisdom, which by the way reminds one of Christian Science, falsely so-called.—*J. M. Bates.*

Fragrant Trilliums.—There is great variation in the time at which plants produce their perfume. Some flowers are fragrant as long as the corolla is expanded, others give off their odors during certain hours of the day and night only, usually at such times as the particular insect which pollinates their flowers is about. Other flowers apparently have no perfume, at least none that the human sense of smell can detect, though it will not do to say that they are entirely odorless, for they seem to be able to attract insects from a distance though hidden, and the inference is strong that the flowers give off odors that the insects can appreciate. Cases in which ordinarily odorless flowers are occasionally fragrant belong to a very different class. What it is that causes single flowers, or a single group of flowers to suddenly become fragrant is difficult to say. Instances that will illustrate this will occur to anybody who has much to do with our wild flowers. The hepatica is practically odorless yet it not infrequently happens that flowers with considerable fragrance are found. In line with this, Mrs. J. D. Tuttle reports fragrant flowers of the nodding trillium near Harrisonville, N. H. The specimens were growing in rich moist soil. Possibly the unusual opportunity for growth induced the additional effort on the part of the flower.

EDITORIAL

Our readers will note with considerable pleasure that a larger number of contributors are taking part in the making of this magazine. We join them in hoping that this assistance will continue. Though single new facts about plants are so abundant as to be found by anybody for the looking, and often appear of themselves, it is a most difficult thing to induce the finder to write up his experiences for publication. We have not yet got clearly in mind the fact that mere bigness is no measure of the value of an observation. It is probably human to want to fill as much space as possible and to disdain what may appear trivial from its size. Even the small fish in the botanical schools aspire to talk like whales. We see this exemplified in our technical journals where some embryo DeVries, after digging around in a University for a year or two, emerges with a bunch of formidable data and proceeds to write what appears to be a very learned article, yet a close inspection often shows that all it contains that is really new can be cut down to a single paragraph, such as we publish in this magazine. Often an entire book may be so cut down, the superfluous matter consisting of uninteresting data upon which the author bases his conclusions. New facts, however, are of the utmost importance. Little by little they accumulate until some scientist more far-sighted than his fellows discovers that by fitting the facts together, the science may be greatly advanced at one bound. Nearly all great advances have come about in this way. Darwin is wrongly credited with the theory of descent named for him. Long before he was born the facts pointing toward such a theory had begun to appear. Darwin's work was to perceive how the facts fitted and to establish the theory upon a solid basis of fact and experiment. The opportunities for becoming a Linnaeus, a Darwin or a DeVries are rapidly becoming rarer, but anybody can be a discoverer of new facts and thus be a very real contributor to the advance of science. We trust that our readers will bear this in mind during the approaching season for outdoor work and study and send us their notes for record.

* * *

It is a mistake to assume that because one has not the leisure or means for foreign travel that he must therefore remain in ignorance of the plants of distant lands. If he cannot go to the plants, he can reverse Mohammed's procedure and bring the plants to himself. There is nobody so poor that he cannot control a bit of land and in possession of this all the rest is easy. Seeds may be bought of the seedsman or secured by exchange from correspondents in other parts of the world. Most botanical gardens offer the seeds of rare and curious plants from remote countries in exchange for even common things in other localities and our Government annually distributes may seeds of this kind in addition to the stuff with which Congressmen endeavor to beguile their constituents in the spring. To plant a packet of rare seeds and watch the subsequent growth of the plants until a previously unknown flower unfolds is an absorbing occupation and a pretty fair substitute for tracking the species to its native lair. Besides, this method avoids the mosquitos, snakes, sunburn, fatigue and other discomforts that fall to the lot of the explorer. In our garden during the growing season, scarcely a day passes without the appearance of some new form among the flowers. A trip around the grounds is a veritable voyage of discovery. Having made various exploring trips of our own in times past, we unhesitatingly pronounce in favor of travel when possible, in spite of its discomforts, but when tied to a desk by circumstances intimately connected with the high cost of living, we perceive that the garden is by no means to be disdained as a source of amusement and instruction.

* * *

The *Journal of Economic Botany*, three volumes of which have been issued by Pomona College, Claremont, California, is no more, having suspended publication with the concluding number of the third volume. Its demise illustrates the well known adage that every institution is the shadow of a single individual. Begun by C. F. Baker, a scientist well informed on tropical botany, it continued to thrive until his removal to the University of the Philippines left the magazine without a responsible head and then the inevitable happened. The magazine was the only publication of its kind devoted to the economic botany of the tropics and sub-tropics and thus filled a want that no other publication could. It is reported that later the magazine will be revived under different management. We trust that this report is not unfounded.

* * *

With much regret we announce the death of Dr. Charles Edwin Bessey, head of the department of botany in the University of Nebraska, author of numerous books and articles on botany and kindred subjects and member of many scientific societies. His death occurred at Lincoln, Nebraska, February 25, 1915, in the seventieth year of his age. Dr. Bessey became interested in botany long before it assumed its present severely technical aspect and through all the changes to which it has been subject, retained a lively interest in the popular and pleasure-giving side of the subject. At the same time he kept abreast of the advances in his chosen field, as his position in a great university shows. His scholarly criticisms of new phases of botany were always received with respect by his fellow scientists. Dr. Bessey was especially friendly toward beginning students and many of the younger generation of botanists will recall with gratitude the kindly words of encouragement received from him. This magazine counted him among its strongest supporters. He was a frequent contributor to its pages and was ever ready to extend its circle of readers. Modern botany, with its passion for exact measurements, for the investigation of the minute, and the cataloguing of the insignificant, no longer produces botanists of Dr. Bessey's stamp. In the passing of such men, however, science loses a certain charm which no amount of present day studies can replace.

BOOKS AND WRITERS

That L. H. Bailey's "Plant Breeding" is a rather remarkable book may be adduced from the fact that since its first appearance in 1895 it has gone through four editions, has been reprinted nearly a dozen times and has been translated into French and Japanese. Nor does its popularity seem to wane, for a fifth "new revised" edition has just been issued by the Macmillan Company. This new book has been entirely rewritten by Arthur W. Gilbert and is, of course, up-to-date in all phases of the subject to which it relates. Students familiar with the earlier editions will not find much change in the arrangement of the text—the titles of the chapters are essentially the same—but the pages are larger and there are 150 more of them, a fact which indicates the growth of the subject and the amount of new matter necessarily added. In a series of appendixes are given a glossary of technical terms used in plant breeding, a list of books on plant breeding, an extended bibliography of the subject from 1905 to the present and a series of laboratory exercises which themselves cover nearly 75 pages. Those interested in plant breeding cannot fail to be instructed by this new edition of a book which has always been recognized as authoritative. The price is $2.00 net.

The present vogue of eugenics renders timely a little book on "The Evolution of Sex in Plants," by Dr. J. M. Coulter, head of the department of botany in the University of Chicago. Most of the matter in the book is not new in the sense of never having been published before, but its arrangement gives a new significance to old facts and makes the subject clear even to the general reader. The author points out the fact that sex in plants is not essential to reproduction. Taking the whole plant world into consideration he finds that the multiplication of individuals proceeds more extensively by asexual than by sexual means. Sexual reproduction, in fact, is the latest of the methods of reproduction to be developed and seems rarely to occur except as vegetative vigor weakens. Its occurrence, however, renders organic evolution more rapid and more varied, since by this method new individuals are produced with the characters of two different lines of ancestry mingled. Among the subjects discussed in explaining the origin of sex are asexual reproduction, the evolution of sex organs, the alternation of generations and parthenogenesis. Dr. Coulter is a clear and forceful writer and his book is sure to be of much help in introducing the beginner to this little-understood phase of botany. The volume contains 137 pages and 46 illustrations and is published by the University of Chicago Press at $1.00 net.

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SOUND BEACH CONNECTICUT

The Silvery Lavender Phlox.—*Phlox Argillacea.*

THE AMERICAN BOTANIST

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In green old gardens hidden away
From sight of revel and sound of strife,—
Here have I leisure to breathe and move,
And to do my work in a nobler way;
To sing my songs and to say my say,
To dream my dreams and to love my love;
To hold my faith and to live my life,
Making the most of its shadowy day.
—Lady Currie.

A VARIABLE PHLOX

By Willard N. Clute.

THE passage of time has only served to confirm the opinions expressed when the silvery lavender phlox (*Phlox argillacea*) was described as a new species nearly four years ago. It has maintained its specific characters in a variety of situations and comes true from seed without showing any trace of *Phlox pilosa* which has been suggested as its probable ancestor. In general appearance *Phlox argillacea* does resemble this latter species, but no more so than it does another species, *Phlox glaberrima,* which grows in the same general region. It is hairy like *pilosa* and tall like *glaberrima,* but the blossoms are unlike either and the time of flowering comes between these two species. Possibly the species began as a sport from one or the other of its allies, but it has progressed along its own lines until it is quite unlike either. That it is not a hybrid is shown by its coming true from seed, and by its differently colored flowers. There is no other species of phlox in the neighborhood with flowers of a similar color.

One of the interesting things connected with the silvery lavender phlox is its tendency to vary within certain lines under cultivation. The variations in flower color, are of course, most noticeable, but it also presents differences in the size and shape of the blossoms, in height and in floriferousness. By selective breeding, four principal strains of flowers have been developed. At one extreme are found flowers of pure ivory white and at the other, flowers of fine, clear violet. Between these there is one strain of pale lavender with deeper lavender nectar guides and another of lavender with a pink eye. In addition to these there are many forms that might be made the basis of further breeding experiments with encouraging results.

A visit was recently made to the type locality of the species in search of other interesting variations from the type, and some two hundred specimens were brought home for further study. There is no doubt but that in this species we have a series of forms quite as extensive and remarkable as those found in the evening primrose which have recently received so much attention.

In the short space of time during which the plant has been under cultivation, it has shown a remarkable capacity for responding to good treatment. In the wild, it seldom sends up as many as a dozen flowering stems—usually the number is less than half a dozen—but in the writer's garden single plants have produced more than 125 flowering stems at one time. The effect of such a mass of flowers is indicated in our illustration, though a photograph but faintly represents the beauty of the plant when in full bloom.

SOME AUGUST FLOWERS

By W. W. Bailey.

THE triumphal march of the Compositae is now well under way. It is led by those gorgeous knights in orange and black surcoats, the *Rudbeckias.* We see them tilting in every field. They hold their own, too, in this tournament—this "Field of the Cloth of Gold." They usurp the lists after the retirement of the sentinel oxeyes. By the way, *Rudbeckia,* itself, should not be called oxeye. That name applies only to the white weed or big daisy of our fields which the beginner is surprised to find is a *Chrysanthemum.* Black eyed Susan is a good and somewhat familiar name for *Rudbeckia hirta.* Another, much taller, species, *R. laciniata,* is our familiar "golden-glow" of the gardens which is getting to be too common.

In sandy regions near the sea-coast, one will notice acres of golden topped aster in this month. It is *Chrysopsis falcata* of science; a bushy little plant with abundant yellow, middle-sized heads, followed by a fluff of pappus. It is sufficiently abundant to affect, by its color, the entire landscape, much as does gorse abroad or the *Genista* in Essex County, Massachusetts.

Plants are well known to grow in cliques or associations. They have their particular friendships. Take, for instance, the intimacy of golden ragwort and painted cup, or *Chrysopsis* with the sensitive plant (*Cassia Chamaecrista*), and many bush clovers. When we find one of these things we naturally look for the others. Plant associations is one of the topics that make ecology so fascinating a branch of botany. One notes the evident affiliations and then tries to determine their probable causes.

The botanist's business would indeed prove a fool's paradise, a happy hunting ground of useless shadows, did it consist alone, as many suppose, in clapping long names in dead languages on very small plants. About it revolve many philosophies and utilities and its interest is undying. Nomenclature has its necessary and important place in the science, but it is not the "be-all and the end-all", here.

Even as early as July, some of the goldenrods appear, bloom and pass away before the more characteristic autumn or late summer flowers put in an appearance. By mid-August, their plumes, big or little, may be seen everywhere. They vary greatly in expression from spicate forms through racemose to open, branching panicles. One species, *Solidago bicolor,* has white rays and is often prettily called silver rod.

Noticeable in swamps at this season is the Joe-pye weed or purple thoroughwort (*Eupatorium purpureum*). These are tall and aspiring, with whorled, veiny, leaves and somewhat flesh-colored flowers. Do not mistake them for swamp milkweed (*Asclepias incarnata*), which often grows near them. The true thoroughwort, *Eupatorium perforatum,* has white heads and as its name indicates the leaves appear to be penetrated by the stem axis of the plant. This results from opposite leaves, which are sessile, uniting by their bases when in the nascent condition. This plant is not a bad tonic in some less serious ailments.

When speaking of the Compositae one should not omit the everlastings in their pure, penitential raiment. Several species will be found of which the prettiest is the pearly immortelle (*Anaphalis margaritacea*), though a pink *Gnaphalium* is always showy. Florists often deform these lovely flowers with blue or purple aniline, as if Nature did not know how to make a flower. In the same way they disfigure the Annunciation lily by removing the stamens lest the golden pollen, forsooth, should stain the white perianth. I think every botanist must shudder to see this deformation.

Perhaps the very tallest of all our wild weeds is the wild lettuce (*Lactuca Canadensis*). Its growth in one season is phenomenal. This, and the extreme variability of its leaves, make it very interesting. I never see one of these big fellows overtopping me but I hurriedly doff my little hat!

Hawkweeds, thistles, Mayweeds—where shall we stop with the Compositae? But after all they do not comprise the entire August flora. As beautiful as anything in the month is the old man's beard, Virgin's bower or Virginian clematis—accent, please, on the first syllable. With what abandon it flings itself over the copses, a perfect wealth of bloom, a wreath for a bride. The sacriligious, who may pull whole yards of loveliness, think nothing of their vandalism. If left unplucked it later feathers out into the well-known winter ornament.

Gaze up yonder brook. What a surprise is there! A bit of the tropics, surely! What significant color! There is a conclave of cardinals, the very princes of the Church. Nature had a full charged palette when she painted these flowers.

POISON OAK AND SOAP PLANT

By Stewart H. Burnham.

CLOSELY related to the poison ivy and poison sumac of the east and quite similar in its effects is the poison oak (*Rhus diversiloba*),of California. La Yedra, as the Mexicans called it, is either a low erect shrub or it may ascend trees by aerial roots to the height of 15 feet or more. The tiny greenish flowers appear with the leaves during the latter part of the wet season in small axillary panicles, and later in the season are succeeded by a whitish berry-like drupe. The variously lobed or toothed (rarely entire) ovate leaflets, at the commencement of the dry season, often turn to shades of brilliant crimson and bronze, and the shrub becomes very attractive. It cannot stand the winters of the high Sierras. It is confined to the foothills and to the inner and outer Coast Ranges, where it often forms thickets along the banks of streams and on cool northern slopes. I seem to be a favored individual, when brought into contact with plants of the sumac family, and only once have I felt any of their virulent effects. One warm February day in 1895, while descending thorugh a ravine in the San Mateo mountains west of Stanford University, along a little path in the chaparral, I was obliged to brush through a considerable thicket of poison oak. Although I tried carefully to keep the bushes from touching my face, still for a few days afterwards one or two little spots on my cheek showed that I had been poisoned.

Mary Elizabeth Parsons in her book, "The Wild Flowers of California," speaking of the poison oak, says: "Horses eat the leaves without injury; and the honey which the bees distill from its greenish-white flowers is said to be excellent." She also states, "any of the following plants may be made into a tea and used as a wash", in case one is poisoned: *Grindelia,* one of the gum plants, which exudes a resinous secretion; *Arctostaphylos* or manzanita, several species of which are found in California; wild peony (*Paeonia Brownii*), which is quite similar in general appearance to the "Christmas rose" of the garden, and is often found flowering near snow banks in the mountains; California holly, Christmas berry or toyon (*Heteromeles arbutifolia*), a beautiful shrub of the rose family with large clusters of red berries among the thick evergreen leaves; the coffee berry or California coffee (*Rhamnus Purshiana* or *R. californica*), known also as *Cascara sagrada* or "the sacred bark." Spanish-Californians and the Indians of the south considered that the root of the peony had a medicinal value, but "in the north its leaves are reputed to be poisonous to the touch." Miss Parsons further states, "Hot solutions of soda, Epsom salts, or saltpeter are helpful to many, and the bulb of the soap-root (*Chlorogalum pomeridianum*) pounded to a paste and used as a salve, allowing it to dry upon the surface and remain for some hours at least, is considered excellent. In fact, any pure toilet soap may be used in the same manner."

An old "forty-niner" in 1856, under the nom-de-plume of "Gold Spring", in discussing the possible remedies for the noxious effects of the poison oak, relates the following incident: "From the effects of this poison, a gentleman with whom we are very well acquainted, was entirely blind for six weeks, his head having swollen to an enormous size, and, in addition to his distressingly painful condition, he was much afraid that it would be fatal in its consequences. Many of the usual remedies, superintended by a skilful physician, were useless and unavailing, until a friend, while visiting him, suggested the use of the soap root, so common throughout California. This was tried with eminent success, for in three days after its application he was able to resume his business. As nearly everyone throughout California is familiar with this root, we need only add that it is used in the same manner as common soap."

The soap plant or Amole (*Chlorogalum pomeridianum*), is a plant of the lily family with a paniculately branching stem, from one to five feet high, springing from a large densely brown-fibrous coated bulb. The coarse, grass-like, undulate leaves are strongly keeled and are borne in a basal tuft. The delicate white flowers, veined with purple, are borne along the branches of the spreading panicle, from the latter part of May to July. The flowers open only during the middle of the afternoon. The soap plant is common on rocky banks and hills to above 4,000 feet in the Sierras, and in the early days its saponaceous bulbs were often used in place of soap.

The Indians of the Sierras have also a curious use for the bulb of the soap plant. The following incident is related by the late Galen Clark in his "Indians of the Yosemite": "The soap-root was used at a low stage of water, late in summer. They dug several bushels of the bulbous roots and went to a suitable place on the bank, where the roots were pounded into a pulp, and mixed with soil and water. This mixture, by the handful, was then rubbed on rocks out in the stream, which roiled the water and also made it somewhat foamy. The fish were soon affected by it, became stupid with a sort of strangulation, and rose to the surface, where they were easily captured by the Indians with their scoop baskets. In a stream the size of the South Fork of the Merced River at Wawona, by this one operation every fish in it for a distance of three miles would be taken in a few hours."

Though practically immune to *Rhus* poisoning, I do not appear to be exempt from the poisonous effect of the hairs of the showy lady's slipper (*Cypripedium hirsutum*), formerly known as *C. spectabile*. I handle the lady's slipper with more caution now than formerly, for one warm day late in June 1908, I was badly poisoned for several days, about the wrists, while gathering this handsome plant to take back to the city.

THE BECKONING HAND

By Mrs. Georgia Torrey Drennan.

THE beckoning hand (*Jatropha multifida*) is one of the most unique and ornamental of our plants. It is a shrub in high latitudes, but here in Louisiana it reaches the size of a small tree. The common name is suggested by the interesting and curious way in which the leaves flutter when the wind stirs. They move up and down with a tremulous motion of the leaf divisions, truly like beckoning fingers. Even when very little air is stirring, the leaflets continue to quiver on account of their broad flat surfaces and thin texture.

The plant comes from seed and grows like a weed. The seedlings produce stems from three to five inches long before the cotyledons unfold. The leaves are palmate and each division has the shape of an arrow head at the end. Seven of these finger-like divisions spread out from a little round palm that the strong straight stem supports, perfectly flat. Every leaf is like an open hand with fingers spread.

As growth proceeds and branches form, these spreading palmate leaves make a symmetrical plant like an open parasol. The center or palm portion of the leaf is light gold color and the divisions are light green. They always suggest new spring growth, and the gold-colored centers of many leaves together are as ornamental as flowers. The foliage and the manner of growth constitute the attractions of the plant, for the flowers, though light yellow and borne in clusters, are not at all showy.

The seeds are borne in a pulpy sack and when fully ripe, two seeds are found with their flat sides pressed together after the fashion of coffee grains. The color of the seeds is greenish gray, like green coffee, but whereas coffee berries or grains are borne in a scarlet pulp *Jatropha* seeds are enclosed in a yellowish-green sack on stems an inch or two long.

PLANT NAMESAKES OF PRESIDENTS

By Charles Francis Saunders.

BOTANISTS have a pleasant practice of sometimes naming newly discovered plants for people whom they wish to honor, and it may not be generally known that in the flora of the United States are plants whose scientific appellations perpetuate the memory of two of our Presidents. The name *Washingtonia,* in honor of Washington, was given by the eminent European palmographer, Wendland, to a genus of stately palms of the Pacific Coast—trees which have been introduced into cultivation both here and abroad, and are known in popular speech as the California Fan Palm.

Barton, a Philadelphia botanist of a century ago, gave the name *Jeffersonia* to a genus of plants represented in the United States by a single species—a neat little white-blossomed herb which blooms in spring woods, mainly of our Middle West. It is popularly known as twin-leaf and rheumatism root, and enjoys some reputation as a medicinal plant, the rootstock collected in autumn possessing diuretic and stimulating properties. It was probably Thomas Jefferson's scientific tastes and labors, rather than his statesmanship, that influenced Dr. Barton in naming this rather uncommon herb; nevertheless, if the great political party which holds Jefferson as patron saint ever wants a party flower, here is one ready to its hand.

SAUCER GARDENING

By Frank K. Balthis.

SEVERAL elements or conditions are necessary to promote plant growth. First, there must be a certain amount of light; second, a certain degree of heat, and third, no plant can exist for any length of time without water. How, then, if light, heat, and moisture are necessary, can plants be made to grow without some of these essentials? None will, but some few are so wonderfully constructed that they have their own reservoirs from which to draw the material they need to produce a certain amount of growth. The bulb of the Devil's tongue (*Amorphophallus Rivieri*) is a monster in size and contains so much food that it will sustain itself sufficiently to produce a flower. The appearance of the bud heralds the approach of another year of life for the plant. Simply place the bulb on a saucer in a warm spot in the south window or conservatory, and almost before one is aware of what is happening the bud will appear. The illustration will give a very good idea of the size and shape of the flower. It often measures three feet in length. The color is a dark purple, spotted with dark red. But the least said about the odor the better, because "distance lends enchantment" for persons with sensitive olfactory organs. It is no doubt necessary for the purpose of attracting insects to insure pollination of the stigmas. After the plant has flowered—towards the end of May—it may be planted out of doors. The leaves grow about four feet high in the form of an umbrella, so that the whole plant is interesting. It is a member of the calla family.

The newly advertised "Byzantine or Wonder Lily" may be flowered in the same way. The flowers are a beautiful shade of pink. Several bulbs grouped together will give a fine cluster of bloom. I have been unable to find the scientific name of this plant, but it appears to be identical with our autumn crocus, which will flower in the same manner. It is probably *Colchicum Byzantinum,* a native of Trasylvania and Constantinople. These bulbs contain only sufficient food to produce a flower. The process of flowering exhausts the supply and causes them to dry up.

The Devils Tongue

Interesting experiments may be carried on in the same manner with a number of other plants. The resurrection plant (*Selaginella lepidophylla*), is wonderfully interesting. In a dried condition it is to all appearances as dead and valueless as a dried-up pig-weed, but place it in a saucer of water and see what happens! The leaflets gradually unfold into as beautiful a rosette as one could wish. The plant is really dead, but the absorption of water causes the leaflets to expand and the bright green upper surface gives the appearance of life. It is a native of Texas and Mexico southward to Peru.

The Rose of Jericho (*Anatatica Hierochuntica*) is another notable resurrection plant. It is an annual found in the Egyptian deserts. When full grown it contracts its branches into a ball and, when dry, is easily carried by the wind. When it is placed in a saucer of water the branches relax and spread out. One of the superstitious tales told of it is that "it first bloomed on Christmas Eve, to salute the birth of the Redeemer, and paid homage to his resurrection by remaining expanded until Easter." It is easily grown from seed but will not endure the severity of northern winters. It must be taken up, kept dry, and used when wanted. It will be noticed that this plant and the *Selaginella* differ from the Devil's tongue in that water must be supplied to induce growth.

To all appearances dead and valueless.

Did you ever try hanging a few leaves of the sprouting leaf on a curtain, or placing them in a saucer? Before many days little plants will appear at each notch in the leaf. No water is necessary. The leaves of this plant (*Bryophyllum* *calycinum*) are deeply divided, the separate lobes being notched. In each notch at the margin is a group of cells which appear as a dot to the naked eye. These cells do not exhibit a tendency to develop as long as the leaf remains on the stem, but just as soon as it is detached the cells become active and a plantlet is formed. Some thick-leaved or succulent leaved plants produce plantlets in a similar manner although the leaves are not notched. "Hen and Chickens" (*Echeveria*) is a good example.

Placed in a saucer of water.

The Barbadoes Lily (*Hippeastrum equestre*) is said to flower without soil or water. So also will the "Monarch of the East" (*Sauromatum guttatum*). It has a flower even larger than the Devil's Tongue, and similar.

AN ALBINO RUDBECKIA

By Willard N. Clute.

IT is well known that albino forms of yellow-flowered species are exceedingly rare. It is true that in typically yellow-flowered genera, such as the golden-rod or the sunflower group, we may occasionally find species with white or whitish flowers, but within the limits of the species, a yellow flower rarely has a pure white form. On the contrary blue and pink flowers frequently produce pure white flowers.

A partial explanation of this condition may possibly be found in the manner in which color is borne in different flowers. Pink and blue flowers are usually due to colored cell sap; yellow flowers nearly always owe their hue to certain colored bodies in the cells called chromoplasts. It is a curious fact that the yellow coloring matter of the chromoplasts becomes red with slight changes and in consequence it is often easier to produce a red flower from a yellow one than it is to produce a true albino. In cases where albinos of red flowered forms are known, it will usually be found that the red color is due to colored cell sap and not to chromoplasts. Chromoplast flowers usually have a tinge of yellow.

In the light of the foregoing considerations, the occurrence of a very pale form of the common black-eyed Susan (*Rudbeckia hirta*) is of sufficient interest to be recorded. In all respects it corresponds to the *primulinus* forms recently named in related genera. To facilitate any further reference to it in print the following name and description will be useful:

RUDEBECKIA HIRTA forma FLAVESCENS f. nov.

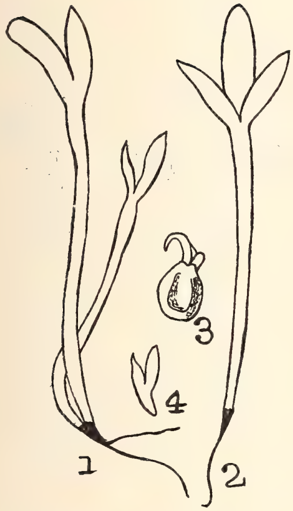
Ray-flowers pale lemon yellow for the inner two-thirds of their length; tips cream colored or nearly white. Otherwise like normal plants. Found near Oak Forest, Illinois, and now growing in the writer's garden.

It is interesting to note that even in this specimen, there is a marked difference in color between the outer and inner portions of the rays as in the form *pulcherrima* (*bicolor*) where the tips are yellow and the inner two-thirds are red. The cause of this curious distribution of color is still a mystery. A careful inspection of the ordinary normal form will show many flower-heads with a deeper tint of yellow on the base of the rays and in others where no apparent difference exists, the camera can still distinguish a contrast. A similar condition exists in many other flowers in this and allied genera, but its utility is at present, a matter of speculation.

POLYEMBRYONY IN OPUNTIA RAFINESQUII

BY EDWIN D. HULL.

IN 1898, W. F. Ganong (*Botanical Gazette*) described in detail from cultivated specimens polyembryony in *Opuntia vulgaris,* the common prickly pear cactus of the Atlantic coast. In 1899 in a brief note in *Rhodora,* he stated that possibly wild plants are not polyembryonic and that it was not known that *O. Rafinesquii* was polyembryonic at all. About 40% of the seeds of the latter species gathered from plants on the sand dunes of Lake Michigan at Miller, Indiana, August 1912, on germination showed polyembryony, a percentage somewhat less than Ganong found in his material (about 50%).



While various degrees of size occur, two embryos, one decidedly smaller than the other, but vigorous and slightly connected at the base (fig. 1), are by far the most common. Three embryos from a single seed have been found but once, although they are not uncommon in *O. vulgaris.* The embryos are but slightly connected and are easily separable and a few are not connected at all, or if so, become separated in the earliest stages of germination. Occasionally an extremely minute embryo is found which in germination is never seen connected with the larger plant, but escapes from the testa when the latter is just appearing (figs. 3 and 4). In these minute embryos, roots are never developed and the plants die within a few days. Rarely specimens with three cotyledons are found but otherwise the plants appear so normal as to make it seem doubtful that there are two embryos closely united, but rather that these are single plants with three cotyledons. (fig. 2).

In *Opuntia vulgaris,* it was found that usually but one embryo developed and hence that polyembryony could be of little service to the species, but in *O. Rafinesquii* among embryos started in the early spring of 1914, all except the minute ones were still alive and flourishing in June 1915.

This is the third case of polyembryony noted among the Cactaceae, the others being in *O. vulgaris* and *O. tortispina.* The latter is figured by George Engelmann in his "Cactaceae of Whipple's Expedition", showing two embryos both fairly large and slightly connected, the usual situation in *O. Rafinesquii.*

NOTE *and* COMMENT

ODOR OF TRILLIUM ERECTUM.—In this section, *Trillium erectum* is of very decided odor. One plant placed in a room 10x10x9 feet, filled the air in twelve hours with an offensive musk-like perfume that became more or less pleasing when reduced with a larger proportion of air. In a bed of fifty in the open, you can detect the odor when standing several feet away. —*E. S. Mason, Utica, Mich.*

NEW NAME FOR THE PARTRIDGE BERRY.—Last September I spent several days in Northam, New Hampshire, some seven or eight miles from the point of meeting of Canada, Vermont, and New Hampshire. Here I found *Mitchella repens,* otherwise known as partridge berry, pudding plum, or pigeon plum, called by a name of possible historic value, viz: Jesuit berry.—*S. F. Sanborn, Concord, N. H.*

THE SPECIES CONCEPTION.—The extreme morphological dissimilarity between some mutations and their parent species must teach us that little reliance can be placed upon the guesses of systematists regarding the relationships in polymorphic groups. The herbarium botanist should clearly realize that his schemes of classification in *Rubus* and *Crataegus,* for example, are probably entirely artificial and do not represent natural relationships at all. Very important systematic characters may originate repeatedly and independently in unrelated lines of descent. There is no test of what constitutes a species, except that it shall reproduce itself from generation to generation. Systematists should have a pragmatic attitude in describing species. Subdivision should extend as far as any one finds necessary. The geneticist needs to have definite designations for much smaller groups than the ecologist or morphologist is likely to be interested in. The makers of manuals should therefore endeavor to produce books which will supply the needs of either class of workers without misrepresenting the facts. If it is necessary to have a more simple treatment of *Crataegus* than that of Sargent, for example, it may be done in such a way as not to discredit a large amount of careful work. The synonomy which is so large a feature of systematic work should be given a different significance. There should be some discrimination between true synonyms which are names applicable to the same identical organism and the names of distinct units which it may not seem desirable to differentiate in a popular manual.—*H. H. Bartlett, in American Journal of Botany.*

VALUE OF PROPER PLANTING.—How stingy people are when it comes to home adornment. Some expect two or three little flowers to cheer up a 160 acre farm. They can't do it. A man builds a fine house and furnishes it with costly furniture and carpets, but the moment he goes out of doors he must have the cheapest of trees and shrubs and a dinky little bed of flowers. The home should be a picture set in a worthy frame, with all the embellishments which art and skill can give it.—*C. S. Harrison, York, Neb.*

VIOLA PEDATA IN ILLINOIS.—Those who keep informed on matters of nomenclature are aware that the bird's-foot violet (*V. pedata*) presents two well-marked forms. The commoner one, which has the name of *lineariloba,* is lavender or lilac purple, while a rarer form, which, however, is considered as true and typical *pedata,* has the two upper petals deep purple and the lower petals much paler. It is commonly supposed, and so indicated in the Manuals, that the true *Viola pedata* is an eastern form that ranges from Connecticut to Maryland, but this is clearly an error, for this form has recently been reported from

Indiana, Iowa, and Northern Illinois. During a recent botanizing trip to Starved Rock, some ninety miles southwest of Chicago, the editor of this magazine found the form fairly common. It grows inter-mixed with the more familiar form and is locally known as the pansy violet. Apparently it is a mere color variation similar to those which are likely to occur in many other species of plants, and is no more worthy of inclusion in a botanical manual than many another that is never mentioned. The botanists are certainly a conservative brotherhood. Let one of their number describe any plant in sonorous Latin and its place in the Manuals is secure. If anybody is inclined to doubt this, let him remember that *Pyrola oxypetala* and *Asplenium fontanum* are still listed as members of our flora.

PLANT LICE.—Certain tiny black, white, green, or red insects, called plant lice, or aphids, often occur on plants in such large numbers that if they do not kill them outright, their attacks are sufficient to check the plants' growth and render them unsightly. The plants most frequently attacked are sweet peas, dahlias, asters, golden glow and the like, but almost any plant may harbor them. The insects suck the juices from the interior of leaves, young stems, and flower stalks, but do not eat the leaves and are therefore not reached by the poisons used to combat chewing insects. When the insects occur in such large numbers as to be objectionable, they may be extirpated by spraying with kerosene emulsion, strong soapsuds or tobacco water, or they may be dusted with ordinary insect powder which can be procured at the nearest drug store. When the owner of lice-infested plants is too indolent to come to their rescue, Nature, herself, helps him out of the difficulty by sending him a few colonies of lady bugs. These familiar, red, hemispherical insects, variously polka-dotted with black, are inordinately fond of plant lice. When they start in to feed on the plant lice on a leaf they usually make a clean job of it. The young lady bugs are worm-like creatures of a general lilac color dotted with red and black, and are truly voracious creatures with appetites out of all proportion to their size. They can eat their weight in plant lice in a very short time. They travel through a colony of plant lice like a farmer cutting grain, and few escape. Seldom is an insect so unequivocably the friend of man as the lady bug. The dragonfly, otherwise known as snake feeder, devil's darning needle and mosquito hawk, which pursues the mosquito in all its varieties, disguises, and haunts, may claim to be first in the list of beneficial insects, but the lady bug is at least second.

Nectar from Fir Trees.—Do the fresh-grown tips of the fir trees secrete or shed a sap-like substance? On June 14, I found a bumblebee very busy on one of the newly-grown tips of the fir and after I got him to take his departure, I broke off the tip and found it to be wet with a sweet sticky substance that tasted strongly of the fir. About a mile further on, I was about to pick a bunch of ferns and found them covered with the same sticky substance. Looking up, I discovered another fir tree which appeared to be shedding this sticky sap. Is this a common occurrence?—*Miss Lilian A. Cole, Union, Maine.* [The writer suggests that the sweet substance may have been honey-dew excreted by plant lice which might have been feeding on the young tips. This could only be ascertained by an examination of the specimens in question. It is a fact, however, that the young cones of certain evergreens excrete nectar and ants often ascend such trees in great numbers for the sake of it. We are accustomed to think of flowers, alone, as producers of nectar, but many leaves and leaf-stalks do the same and even plants, such as the ferns, which never bear flowers, have nectaries on the leaves and excrete this same sweet fluid. From the fact that the substance in question had a flavor of fir in it, we are inclined to think that it was nectar secreted by the tree.—Ed.]

Suspending Mendel's Law.—Mendel's Law, rediscovered no longer ago than 1900 has already become about as familiar to the general public as the Darwinian Theory, largely because of the vogue it has had among dabblers in eugenics. The law is so simple that it is surprising that its existence was not earlier discovered on purely theoretical grounds. When two species possessing characters that differ in any respect, such as colored and colorless flowers, are crossed, one character becomes dominant over the other and the resultant progeny therefore resemble the dominant parent. When, however, the members of this new generation are bred together, the missing or recessive character is likely to appear in one-fourth of this second generation. This is explained by assuming that all the plants resulting from the original cross had the potentialities of both parents, though only one of each differing pair of characters could appear at first, but when these latter plants are bred together, the uniting cells pair in such a way that some plants receive only characters derived from one parent, other plants received only characters derived from the other parent, while still others have, like the first generation, mixed characters, one of which is dominant over the other. If cells containing only elements likely to produce white flowers united with other cells of the same kind, only plants with white flowers could result. The same would be true if the uniting cells or gametes carried only the elements for red flowers; only red flowers could result. Now, the scientists have found a way of suspending the workings of this law by fertilizing the second generation from one of the original parents. The next generation, then, cannot produce both dominant and recessive plants, for the new union does not give an opportunity for the characters of the two original parents to separate out in pairs. The uniting gametes from the fertilizing parent are all of one kind. By this method when a desirable cross is obtained, no risk need be run that the next generation will produce two varieties of the plant. This should be of much interest to seedsmen and others who are desirous of securing strains that will not "revert" to a less desirable parent.

OENOTHERA LAMARKINA A HYBRID.—Probably everybody knows by this time that a new theory of evolution, called the Mutation Theory, has arisen to shake our confidence in a too literal interpretation of the theory of the origin of species for which Darwin and Wallace were largely responsible. The new theory rests on a considerable basis of experimental proof but the plant with which the most astonishing feats have been accomplished, *Oenothera Lamarkiana,* is somewhat under suspicion. Though described as a species and until recently so considered, it has never been found wild except in a certain small area in Holland where it is known to be an exotic. It is from this plant that a number of forms quite different from the parent plant have been produced without intergrading variations, which fact has played an important part in the interpretation of the mutation theory. If the plant is a true species, then the production of these forms is remarkable, but if the parent plant happens to be a hybrid, the production of different forms is nothing out of the ordinary; in fact, is to be expected. As the investigation of the evening primrose (*Oenothera*) goes on, it becomes more and more apparent that *O. Lamarkiana* is really a hybrid between other species, possibly between *O. grandiflora* of the Southern States and our common form of waste grounds, *O. biennis.* This fact makes the production of new forms in this species less wonderful, but it does not militate against the mutation theory itself, for the grower of plants may see mutations of various kinds in any large collections of a given species if he cares to look for them.

SHADBUSH FLOWERS ILL-SCENTED.—One of the species of shadbush (*Amelanchier*) has blossoms that are quite ill-smelling. The shrub is of medium size and grows on pine plains, perhaps elsewhere. Which species is it? I have failed to identify it.—*Miss S. F. Sanborn, Concord, N. H.* [Possibly the odor mentioned may be a peculiarity confined to certain plants in the locality mentioned, in which case the species could scarcely be identified by this means. We have never noticed the obliquity in the fragrance. We are, however, all likely to assume that what we find true of one lot of plants must be true of the species as a whole. The hepatica is commonly regarded as lacking fragrance, yet in some localities it has a distinct perfume. Other apparently odorless flowers may occasionally surprise us by the occurrence of some individuals possessing perfume. There may also be a difference in the quality of the perfume. All sweet-scented flowers are not equally fragrant nor are all ill-scented flowers equally bad. The flowers of *Ailanthus* are reputed to be exceedingly ill-scented, but many that we have examined appear to be almost odorless. A further study of the shadbush blossoms would be interesting.—Ed.]

Paired Narcissi.—The poet's narcissus is a well-known spring flower which is borne singly on a long stalk. The polyanthus narcissi, represented by such forms as the Chinese sacred lily and the paper white narcissus, produce many flowers on a stem, but the poet's narcissus normally produces but one. Last season, however, several plants of the latter species produced twin flowers, in this feature approaching still another species, *Narcissus biflorus,* which always bears two flowers on a stalk. *Narcissus biflorus* seems to have once been more common in cultivation than it is at present. It may still be found occasionally in old fashioned gardens where it goes by the name of primrose peerless. It is the latest of the narcissi to bloom and often comes so late as to deserve its common name of June narcissus.

New Forms of Rudbeckias.—The ease with which almost any wild flower may be made to yield new varieties is well illustrated by the black-eyed Susan (*Rudbeckia hirta*) which in the course of two or three years in the editor's garden has produced an immense number of variants. Some of these have been thought worthy of varietal names but a host of other and less striking forms have annually been pulled up and thrown away, or given to flower-loving friends. The variety *tubuliforme,* with all the rays quilled, was produced in a single season by sowing seeds from a flower-head which had a few quilled ray-flowers. Flowers of pure red, bred from the variety *rubra,* as well as all gradations between this and the form *pulcherrima,* are common. A partly double form has also appeared in this season's plants and it is likely that one or two seasons experimenting will result in double flowers. Most of the variations thus far produced are of interest to the student of evolution only, but some others are worthy of a place in any flower garden.

AN ELEMENTARY SPECIES OF WHITE CLOVER.—Many of the elementary species which DeVries has pointed out as existing in practically all botanical species may be found by anybody who will take the trouble to look for them. If you have noticed a plant that differs from the normal, it is likely to be one of these lesser forms which are included in what we ordinarily call a species. An interesting illustration of this appeared in the editor's grounds last spring in a plant of white clover that had added to its color scheme. As everybody knows, the three leaflets of this plant are marked near their bases by an angular whitish blotch. In the variation mentioned this mark has spread over the whole base of the leaf and taken on a tinge of yellow. If the form were worth anything, it would be easy to breed up a race of plants with this characteristic.

REMEDIES FOR IVY POISONING.—With reference to the note in your February number regarding poison ivy dermatitis, I can add *Antennaria* sp. to the list of alleged remedies. An infusion of an unnamed species of this genus I have heard highly recommended for the disease; but I think with you that none of these plants has any real virtue. Ivy poisoning without any medical treatment whatever runs its course in about three weeks, and most of these supposed cures owe their reputation to having been used when the inflammation was subsiding naturally. A physician friend, who has made a special study of ivy poisoning, tells me that no specific for the trouble has yet been discovered. The most efficacious remedy known can only reduce the period of attack from its normal length of about three weeks to one week or ten days. No better cure is known than the application of the alcoholic solution of sugar of lead, the philosophy of this being that the alcohol dissolves the fixed oil which causes the irritation, and the astringent sugar of lead dries up the pustules. The irritating oil is also readily soluble in soap and water, and as it takes some time to produce its effect, if exposed parts are well washed with soap and warm water within two hours of the time of infection, no poisoning will take place.—*Chas. Macnamara, Arnprior, Canada.*

Coloring Matter in Leaves.—Whenever the scientist investigates a subject he finds it more complex than we imagined it to be—or he makes it so. We used to think that leaves were colored by chlorophyll but we shall have to revise our views if the findings of two investigators recently published in *Science* prove to be true. In peach leaves they found all of the following: Two forms of chlorophyll, phytorhodin, chlorophyllin, phaeophytin, phaeophorbide, methyl-phaecphorbide; methyl-chlorophyllid, phytochlorin, carotin and xanthophyll.

Odor of Galax Leaves.—The galax (*Galax aphylla*) whose rounded green or bronze leaves have become well known in recent years through their use in the florist's creations, is reputed to have at times a decidedly rank odor which some Southern writers are inclined to term a "polecat smell," polecat being the polite Southern expression for a certain black and white nocturnal prowler which can be smelled farther than it can be seen. Another writer has characterized the odor as "a faint sickly carrion scent." The odor seems to vary in strength and may often be absent, especially if the leaves have been picked for some time. There are a large number of plants whose leaves when bruised give out an odor. Among these may be mentioned the skunk's cabbage, sassafras, sweet fern, catalpa, lavender, sage and the other mints, but cases in which plants give off odors without being bruised from parts other than their flowers are not so common. The maidenhair spleenwort has an odor of this kind and so has the boulder fern (*Dicksonia pilosiuscula*) while various tropical ferns exhale much stronger odors. That such emanations have no connection with pollination is easily understood from the fact that ferns, which never bear flowers, possess them. Probably it is only some by-product of the plant of no more significance than the yellow color of the carrot or the red of the beet.

Catapult Fruits.—The most conspicuous way in which seeds are distributed is by means of wings. The wings may be on the fruit, as in the maple, ash and elm; on the seed itself, as in the milkweed, catalpa and trumpet creeper; or on a bird which eats the juicy pulp surrounding certain seeds and allows the seed to fall to the ground. Another and possibly even more common method of seed distribution is by propulsion, but owing to its inconspicuousness it seldom receives much attention when the subject of dissemination is up for discussion. The witch hazel is the classic example of a fruit which shoots its seeds from the capsule, but there are many other plants that far surpass it in this respect. The sand-box tree (*Hura crepitans*) one of the tropical spurges, has a fifteen celled woody fruit larger than a tennis ball which splits into many pieces with a loud report, scattering the disc-shaped seeds in all directions. It may be said in passing that the botanical name for this particular kind of fruit is *regma*. In our own New Jersey tea, the seed is often thrown a thousand times its length and some violets may even exceed this performance. There are a vast number of insignificant seed pods that scatter their seeds in the same way. In practically all cases it is dryness that sets the spring by means of which the seeds are discharged. In such pods there is a layer of elastic tissue that becomes tightly stretched as other parts of the pod dry out. When some weaker part finally gives way, the seeds are hurled to a considerable distance from the parent plant. A variation of the method is found in the violet and some others in which the initial fracture merely opens the pod and the seeds are eventually discharged by the pressure upon them of the drying and shrinking valves. In the small seed-pods, this bombardment proceeds with little or no noise, but when the species is growing in dense patches the collective popping becomes audible. Thus when the sun shines for a few hours on the silvery phlox (*P. argillacea*) at just the right time, the miniature cannonade is quite noticeable. Akin to this but still more wonderful is the fact that the opening of fern spore-cases may occasionally be heard. If one holds heavily fruited fronds of certain tropical ferns to the ear as they are drying, a continuous crackling sound can be heard due to the opening of countless almost microscopic spore-cases.

Trees Killed by Mushrooms.—The presence of various mushrooms and allied plants on dead trees and fallen logs is not unusual, but the majority of such species seem incapable of attacking living trees; indeed, some species have entered into partnership with the trees and act somewhat like root hairs in securing food for them. A smaller number, on the other hand, are decidedly harmful. Though unable in the beginning to attack the living parts of the tree, if they once become established in some injured part, they are able to ultimately extend their depredations to sound tissues. A recent report from the Department of Agriculture accuses the honey colored mushroom (*Armillaria mellea*) of being one of the worst species in this respect. The underground, vegetative portions of the plant consist of brown or blackish string-like growths that may reach a length of fifteen or twenty feet. These ramify about between the wood and bark of the trees and ultimately cause their death through decay of the living tissue. It is reported that the luminosity of these fungus strands is what causes the phosphorescent wood which one often finds in the forest. The *Armillaria* strands are familiar to woodsmen who call them "shoe-strings." The fungus has been found on various cone-bearing trees as well as on the white oak, chestnut, poplar, maples and Juneberry (*Amelanchier*). Several regions have been discovered where the chestnuts and oaks are dying off rapidly from the attacks of this fungus.

Keeping Flowers From Wilting.—During the warm weather it often happens that a bouquet of flowers placed in water begins to wilt at once, although flowers of the same kind may on other occasions, show no disposition to do so. The trouble is due to the way in which the flowers are gathered. If gathered when the sun has been shining on them for some time the pull of the evaporating water which is being given off by all parts of the plant, is sufficient to set up a decided tension in the water carrying tubes of the stem and when the stem is cut the tension draws the sap, and after it the air, into the small tubes. While a continuous column of water in the tubes, or ducts, as they are called, will continue to pull up more water, a bubble of air introduced into this column at once breaks the flow. If flowers are gathered early in the morning or on dull days, no wilting is likely to occur if they are at once put into water, but on other occasions the proper way is to plunge the stems into a basin of water, and while under water to cut off an inch or two of stem, which will thus get rid of the air-filled space and make a continuous water column again.

A Mix-up in Tulips.—As everybody knows, each tulip bulb produces a single large flower on a scape. During the past spring in our gardens, several double tulips, not content with producing double flowers, that is, flowers having numerous petals, have put up a common stalk upon which as many as four tulips were borne. The cause of such freaks is hard to discover. The treatment of the freakish plants differed in no respect from that given other normal plants near by except that just as they were pushing through the soil the mulch with which they were covered, accidentally caught fire, and burned for some time. A fire in the haunts of the cinnamon fern is known to be the cause of the variety *frondosa*, but it is scarcely likely that the additional flowers of the tulip were due to this stimulus.

INSECT BOTANISTS.—The inexperienced often think of insects as omnivorous feeders, willing to eat anything that happens to be valuable, but this is far from the truth. Adult insects, at least such as live on nectar, may flit about from blossom to blossom careless of their botanical affinities, but their larvae are usually more particular and demand their proper food plant. When egg laying time comes, the hitherto carefree butterfly or moth must be certain of the identity of the species upon which the eggs are deposited if she is interested in continuing her particular family line. In cases where the family food plant is rare or absent, other nearly allied plants may often answer. In a pinch the potato bug will eat tomato, egg plant or even the petunia of the garden. The cucumber beetle has a fondness for many of the melon or gourd family. In the case of boring larvae, however, which enter the stem and feed on the interior of the plant, the species are often restricted to a single host. This close association of insect and host-plant has a curious bearing on a botanical problem that is at present being discussed. The hop vine is a native of Europe and Asia, and is apparently widely distributed in the New World. There is some question, however, as to whether the Old World plant and the one found in North America are identical. Botanists are divided on the subject, but the insects have settled the matter to their own satisfaction in favor of there being two species; at least, each form has a different species of boring larvae that infests it. If such cases continue to multiply, the species makers will require a course in entomology as well as in archaeology before they can consider themselves fully equipped.

White Cypripedium Acaule.—Many times I have wondered over the absence of any reference to the pure white Cypripedium acaule in any botany or book of wildflowers to which I have access. I have found the very deep reddish-pink form, the one which is white with pink veinings and slight blush shadings, and the pure white one. Is the variation in color due to more or less moisture? And why is there not a special name attached to the white form? I have found the latter in the more open sunshine on a knoll or a decayed stump of a tree and the deeper pink form in more shaded places.—*Miss Lilian A. Cole, Union, Maine.* [The white form of *Cypripedium* noted is an albino and as such is not likely to be much affected as to color by any degree of moisture or sunlight. The pink flowers, on the contrary, are likely to be deeper in color in the sunshine. It is the nature of most flowers and fruits to become most highly colored when exposed to the sun. The light itself, has considerable to do with developing color. So great is this power that if one will place a photograph negative in contact with the sunny side of an apple just as it is beginning to change color, he will, if the experiment has been properly performed, get a fairly good print on the apple. A negative having strong contrasts, is of course, best for this purpose.—Ed.]

EDITORIAL

This magazine has been moving to a new and more spacious location and the attendant confusion of such an event, together with much added labor, has retarded this number somewhat. However, in the region where the magazine is issued, spring seems to have been retarded nearly as much, and though, according to the calendar, it is no longer May as this is written, according to the temperature it is not yet June. Our endeavor had always been to make the magazine fit the season as far as possible, and we see no impropriety in dating this number for May until the temperature takes on more of a summer character. It is quite against our principles to catch up by the easy method of doubling up on the numbers, and our subscribers may expect four issues as usual, though perhaps the next one will be slightly delayed.

* * *

The migration to our new location seemed to offer a good opportunity for disposing of our accumulation of back numbers and we accordingly sold all of them to a dealer in waste paper. With the exception of a few complete sets of the magazine, which we have in stock, there is now not a single back number or back volume to be had. Those who have complete files will appreciate the fact that the destruction of the back numbers has greatly increased the value of their own copies but prospective purchasers of the few remaining files may be assured that at present we do not contemplate a further advance by manipulating things after the manner of a certain book agent, named Sibyl, who tried to sell a set of future histories to the Hon.

Tarquinius Supurbus when he was in power on the banks of the Tiber. We are still willing to sell a complete set to date for $11.00 but we have not many to sell. We have also sold all the back numbers of the *Fern Bulletin.*. The latter magazine ran through twenty volumes and at its demise, in 1912, there were only thirty-two complete sets in existence. These sets have since rapidly advanced in price and the sets of the *American Botanist* are bound to do the same. Those who lack complete files would do well to complete them at once—but do not ask us to sell the odd volumes.

* * *

In a recent issue we commented upon a horrendous story relative to an ant's head walking about by itself, in which we took the ground that the author of the story must be a nature faker of the deepest dye, inasmuch as an ant's legs are attached to its thorax and not to its head. The feat is clearly impossible for lack of feet. *The Guide to Nature,* however, reprinted the article and immediately got into hot water, for the author of the story happened to see it and indignantly aserted that ants' heads do walk about without bodies and suggested that we adopt as our motto the time honored phrase, "Be sure you are right and then go ahead." A careful survey of the matter however, convinces us that we need not hesitate to put on the accelerator. The facts are that a certain parasite lays its eggs in the ant's back hair and when the egg hatches the larva gnaws off the ant's head, and makes himself a cunning little domicile where the ant's brains used to be, thereafter dragging or pushing the empty head about as a hermit crab drags its shell. But what this has to do with an ant's head walking around by itself, is more than we can fathom. Possibly we are expected to play the game according to the rules, but in that case we can tell much more remarkable tales than any that relate to an automobile ant's head. We know of a dinner pail that walks two miles to work every morning and at noon visits a saloon and comes back filled with hop extract like a common laborer on pay-day. We have seen a board walk, a horse fly, a tack hammer—but an ant's head walking around by itself, Never! All the trouble comes from making the story bigger than the facts warrant. We once wrote an article on insectivorous plants for one of the magazines and it appeared under the title "Plants That Eat Meat," and we almost lost our reputation as matter-of-fact scientists. We have since preferred plain facts to the most ornamental fiction.

* * *

According to the prospectus of a new scientific publication which is soon to appear, it will have four times as many pages as this magazine and cost eight times as much. We have no doubt that such a publication is needed, but we question whether it is desirable to assume at once that nobody but a few scientists will want it and to place the price beyond the reach of the beginner. We really need cheap publications in all the sciences; otherwise the rising generation will think more of golf and the movies than of useful knowledge. The advance of science is not helped by an advance in the price of the literature relating to it. If all the scientific publications are to cost from $6 to $10 a year, beginners will be discouraged and science lose in consequence.

BOOKS AND WRITERS

During the week commencing September 6, the New York Botanical Garden will hold a celebration in commemoration of its twenty-fifth anniversary. The program for the week consists of a series of excursions to nearby points of interest and sessions for the reading of papers. Everybody botanically inclined is invited to be present and read a paper and since New York is within easy reach of a majority of American botanists, a very interesting and successful meeting is assured.

Something new in the way of notebooks is embodied in Prof. D. S. Hartline's "Guide to Note-Taking in Nature Study." This is a sort of pocket portfolio containing loose sheets for notes, each sheet a little smaller than a postal card. The essential part of the Guide, however, is a series of printed headings for the divisions of nature intended as an index to the notes. Along with these headings are printed many quotations from nature literature which the author suggests ought to put one in a worthy attitude. The Guide is for sale by the author at the State Normal School, Bloomsburg, Pa.

The Fifth edition of L. H. Bailey's "Principles of Fruit Growing" has appeared as one of the volumes in the Macmillan Company's Rural Science Series. The fact that the book in its original form was reprinted at least twenty times attests its merit, and the new edition has been further improved by being carefully re-arranged and re-written. At present it consists of ten chapters, which exhaustively discuss the location, tillage, fertilizers, layout and care of all kinds of orchards in temperate regions, with directions for spraying, gathering, and marketing the fruit. Practically everybody who owns an up-to-date orchard has a copy of the book, and all who expect to become orchardists had better get one. The new edition costs $1.75.

"A Spring Flora for High Schools," consisting of a key to the species that bloom before July, with a rather untechnical description of each, by Doctors C. H. Cowles of the University of Chicago, and J. G. Coulter of the University High School, Normal, Ill., has been issued by the American Book Company. The Key will be most useful in the States north of the Ohio and east of the Mississippi, but will apply to some extent to regions beyond. The authors disclaim any attempt to include all the spring flowering plants in the region, selecting, instead, the more conspicuous species which "every amateur botanist should know." In the opinion of the reviewer, however, every flora should be complete for the area and time covered. The young student, having some difficulty in naming a specimen and knowing in advance that it may not be in the book, is too frequently disposed to give it up. The student needs to know that proper application will always meet with success. The key in the present book, is different from other keys, in that the specimens may be traced to the species instead of the genus—a most commendable feature. The duplication of key letters, however, is likely to confuse the beginner. We note the omission of the species under *Delphinium* and *Tradescantia* and fail to find mentioned various showy wildflowers that bloom before July, such as the white water lily and *Polygala pauciflora.* An abundance of good illustrations make the work of identifying easier for beginners. The Flora by itself, costs 60 cents. It may also be had with either Coulter's "Plant Life and Plant Uses" or Andrews' "Practical Course in Botany" for $1.50. The first mentioned book, issued in 1913, has had a wide use considering the short time it has been in the market, and the second is an admirable volume first issued in 1911 and revised by F. E. Lloyd.

When one has passed the "how to know" and "how to do" stage in his gardening career, such a book as Mrs. Francis King's "The Well Considered Garden" will appeal. The book is short on making hotbeds, fighting cutworms, pruning plants and such matters, but is full of well-considered observations regarding the most atractive plants for the garden, their arrangement in harmonious color effects and the like. Other matters considered are gardeners, gardening books, garden accessories and garden expedients. All who are interested in making the most of their gardens from an artistic viewpoint should have a look at this book. It consists of nearly 300 pages and numerous illustrations and is published by Charles Scribner's Sons.

Since practically all teachers of agriculture include experiments with soils in their courses, the "Agricultural Laboratory Manual—Soils," by E. J. Sell, should interest them. It is a loose-leaf manual of 40 experiments and though this is a greater number than can usually be included in a single course, it offers a chance for selection to suit the wants of individual teachers. The topics for study are well chosen and the directions seem likely to save the teacher much labor in preparing for classes, but one serious defect mars the book in the opinion of the reviewer. The author appears so anxious to have every experiment come out exactly right that the student is frequently told what he ought to find out for himself. The manual costs 35 cents and is published by Ginn & Co.

In the language of plant students, "wildflower preservation" has two widely different meanings. To one group it means preserving plants in museums and herbaria; to the other it means the prevention of preserving them in these same institutions. A little book issued by the F. A. Stokes Company, with the title "Wildflower Preservation", has to do with the museum and herbarium side. It is a British book, written by May Coley, and revised for American readers by C. A. Weatherby, and aims to aid the beginner in making an herbarium, and in studying the plants. A good glossary with illustrations occupies about one-fifth of the book. While the volume may be of considerable use to the tyro judged by professional standards, it is in some respects behind the times. The practical plant collector would object to carrying with him much of the impedimenta recommended and will regret that there are not more specific directions for handling the lower orders of plant life. The reviser betrays surprising unfamiliarity with American literature and such books as Bailey's "Botanizing" seem all unknown. The book, however, pretty accurately described British methods and is of interest on that account. It costs $1.35 net.

We find it difficult to imagine a more useful and inspiring book for the plant student than that which is included between the covers of "Practical Field Botany", by A. R. Horwood. The title exactly characterizes the book which deals with practically every phase of botany that can be studied in the field, with a fair addition of other matters not so closely connected with such work. It would take several lifetimes to carry out all the investigations suggested or to answer half of the questions propounded, and anyone who has a taste for plant study ought to be able to select material here for many pleasant hours of work. Though the book is written primarily for British students, its value for use on this side of the water is not impaired since many of the species mentioned are common to both countries, and the rest belong to familiar genera and are own cousins to our species. Several good illustrations add interest to the text. The book is published in this country by the J. B. Lippincot Company and costs about $1.50.

It is a poor publisher, indeed, who has not issued at least half a dozen text books on agriculture and methods of treatment are almost as numerous as the books themselves. Some deal with the plant side only, some with plants and animals, others deal principally with soils, and so on. In Henry Jackson Waters' "Essentials of Agriculture" from the press of Ginn & Co., we have a volume that plunges at once into the methods of improving plants and animals, then takes up soils and their properties and continues with a discussion of farm crops and farm animals, the whole running through 37 chapters. A good share of the book reads more like a Commercial Geography than a farm manual and is too patently designed for recitation purposes to suit the reviewer, who is of the opinion that the high school student needs directions for actual work and exercise under these directions instead of recitations *about* farming. There are more than 200 good illustrations and some 475 pages of text in the book, which costs $1.25.

It may be questioned whether the exercises in J. G. Coulter's "Notebook and Laboratory Manual" will give the student a very connected idea of botany, but it will certainly induce him to think about plants as living things and their relations and uses to man. The notebook is arranged on the loose-leaf plan, and consists of 72 exercises concerning various phases of plant morphology, physiology and ecology, each exercise on a separate page. There is also space on each sheet for notes required. The Notebook has been made to accompany Coulter's "Plant Life and Plant Uses", but it is not necessarily restricted to that book, and it is likely to be welcomed by teachers in schools where living plants are still used in botany. Those who are teaching about outdoors indoors will of course stick to their charts, microscopes, and their dried and pickled specimens. The Notebook is published by the American Book Company.

California continues to furnish attractive subjects for the pen of Charles Francis Saunders. His latest work, issued from the press of McBride, Nast & Company, New York, is entitled "With the Flowers and Trees of California." It is not, however, a manual for naming the wildflowers as the title might suggest. It is a book about the more familiar plants that the visitor to California may encounter and discusses their uses, origin, folklore and general manner of life in a way that ought to appeal to the tenderfoot intent on knowing something of the vegetation of that flowery part of the world. The author has a fresh and pleasing style which is far to be preferred to the technical jargon of the closet naturalist, and no doubt his book will find a wide circle of readers. Visitors to California, especially, ought to find it pleasant reading on the way. Half the interest in a new country is found in the differences in the outdoor world which it presents, and a book which adds to the interest by telling something about the differences is a desirable acquisition. The book contains 276 pages and is well illustrated from photographs by the author and color plates by Elizabeth Hallowell Saunders. The price is $2.50 net.

Allen French, whose book "How to Grow Vegetables" has been of much service to amateur gardeners for a number of years, has issued a more elementary volume entitled "The Beginner's Garden Book." The title describes it as a textbook for the upper grammar grades but we are somewhat inclined to doubt whether it will find much use for this purpose. The curriculum is already too crowded to admit of the use of an additional book of 400 pages. As a reference book for children in the upper grades or for the teachers of these children, it is likely to be of real service. It is written in understandable language and illustrated with appropriate pictures of gardens, plants and plant parts. There are four sections in the book devoted to Autumn Work, Winter Work, Gardening Under Glass and the Real Garden, thus following the seasons from autumn to summer much as the school course does. In an appendix the commoner vegetables and flowering plants are listed with notes on their cultivation, etc. The book is published by The Macmillan Company at $1.00 net.

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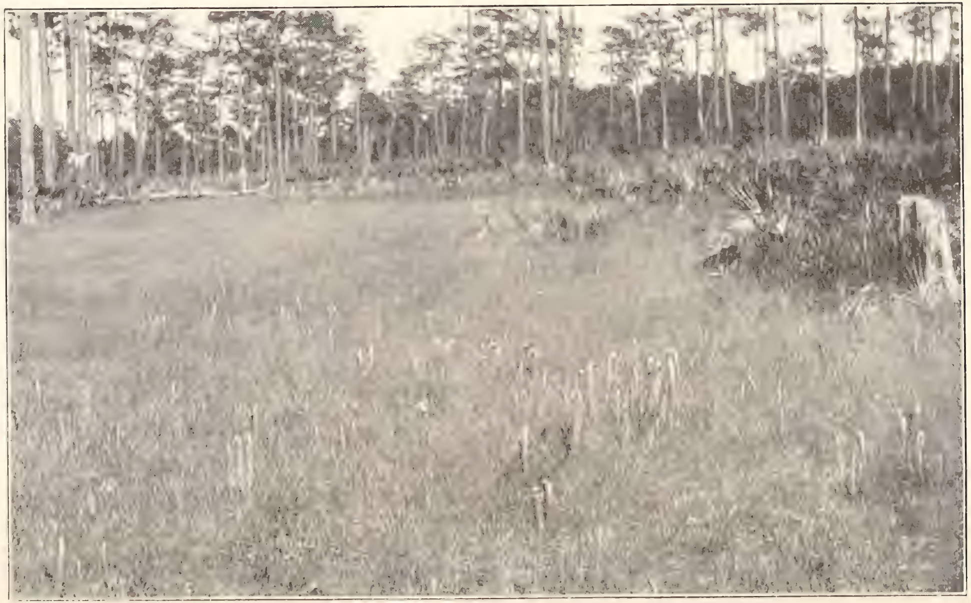


Home of the Spotted Trumpet Leaf.—*Sarracenia minor.*

THE AMERICAN BOTANIST

VOL. XXI JOLIET, ILL., AUGUST, 1915 No. 3

I wander to the zig-zag cornered fence
Where sassafras entrenched in brambles dense,
Contests with stolid vehemence
The march of culture, setting limb and thorn
As pikes against the army of the corn.

—Sidney Lanier.

THE SPOTTED TRUMPET LEAF

NOV 29 1915

By Walter M. Buswell.

As nearly all of our plants, both cultivated and wild, are eaten by some species of insects, their leaves or fruit destroyed or often the whole plant killed, it seems no more than right that insects should in turn be eaten by plants. This is just what happens when some unfortunate insect chances to walk into the parlor of the pitcher plant. The story of the spider and the fly might well fit the case of this plant and its insect visitors, for it is indeed one of "the prettiest little parlors that ever you did spy" and the insect that walks in never returns.

There are several different species of pitcher plant in the United States but the spotted trumpet leaf (*Sarracenia minor*), is the only species I found in the pine barrens of Central Florida. In many places the handsome slender trumpets and large lemon-yellow flowers of this plant thickly studded the open grassy places often several acres in extent. The leaves varied from tiny trumpets two or three inches high up to fifteen inches, all perfectly formed and colored.

There are few plants in this country as peculiar in structure and in habits as the different members of the Pitcher-plant family (*Sarraceniaceae*). The leaves of the species here discussed are erect slender tubes with a beautifully purple-veined hood arched over and nearly closing the opening. On one side of the leaf, opposite the opening and near the top, are numerous white, translucent, spots like windows, and opposite the windows, a broad wing extends from base to summit of the leaf. The opening into the tube is smooth, but below this is a band of stiff downward pointing hairs. A secretion of sweet liquid around the opening attracts the insects and leads them down over the stiff hairs. Going in this direction the hairs are easy to pass, but no insect can return over the bristling points.

One might think that an insect with wings could easily fly out of the trumpet and thus avoid the line of stiff hairs, but the trumpet leaf is prepared for just such an emergency. The mouth of the trumpet is concealed by the arching hood and in seeking a way out, the insect is attracted to the translucent spots, like well lighted windows, which seem intentionally placed on the side opposite the real opening. Against these spots it beats, as a bee or bird does on finding itself shut up in a room, until it falls exhausted into the pit below, where along with other insects that could not fly, it is eventually absorbed by this vegetable trickster. I have often found a solid mass of black ants and other insects, two or three inches deep, at the bottom of the tube.

The leaves of the northern pitcher plant (*Sarracenia purpurea*) are open at the top and the lip is turned away from the mouth like a real pitcher, but the opening has a similar zone of stiff downward pointing hairs to prevent crawling insects from leaving. Flying insects are nearly as helpless in the pitcher as they are in the trumpet, for although the entrance is not closed, the pitchers are always partly filled with water and having fallen into this, they are unable to fly out with wet wings. Thus we see how perfectly everything is planned in nature's workshop. No matter how odd a flower or leaf may be, there is reason for its being just as it is.

Large drooping yellow flowers on long stems.

The species with open pitchers is always found in wet mossy bogs in a cooler climate, and there is little chance of the pitchers ever becoming dry. The trumpets of the South, on the contrary, are found in rather dry sandy places in a much hotter, dryer climate, where rainwater if collected in the leaves, would soon evaporate and leave nothing to prevent their winged visitors from going in and out at will. Therefore, these two members of the same family with the same carnivorous traits have leaves or traps that are very different, One holds its victims by means of a trick while the other makes use of a more open plan, yet the result is the same, as an examination of the pitchers or trumpets will prove. Although it is sometimes stated that the closed trumpets are always found with water in them, I have not found it to be so, though there is probably sufficient moisture in the tube to aid in the decomposition of the insects.

I found the spotted trumpet leaf in full bloom early in April, the large drooping yellow flowers rising on long stems from near the base of the leaves, usually one or two in number. The flowers are attractive even after the petals have fallen, as they then show the little inverted umbrellas of the style. With the trumpets were hundreds of beautiful pogonias also in bloom, the flowers larger and with more on a stalk than are usually found on the same species in northern bogs.

After the almost daily botanizing trips of a winter and spring in Florida, there are none I remember with more pleasure than the few days spent among the little insect-catching trumpets.

SOMETHING ABOUT GOLDENRODS

By Dr. W. W. Bailey.

WHEN the botanist hears someone, as is often the case, speak very definitely of *the* goldenrod, he is apt to smile. The very greatest variety prevails among the twenty-five or more species inhabiting New England. Some, one would hardly guess to be goldenrods at all so unlike are they to the type generally accepted.

Take some extreme instances. There is, for example, *Solidago bi-color* with white rays and yellow disk-flowers, or *S. lanceolata* and *S. Tenuifolia,* bushy in habit and with broad, spreading, clusters of minute heads, disposed in compound corymbs. I have many times tested people on these and found they had no suspicion as to what they were. Then for size of heads, compare the very large splendid ones of the maritime species so common on the sea-coast or along our bay shores. It is the *Solidago sempervirens,* very stout, with smooth, entire, narrow, leaves. One never finds it far from the shore. Another species with extraordinarily large heads is *Solidago rigida,* its broad leaves as harsh as a file to the touch. In Rhode Island this is one of our very rarest kinds.

In height the species vary from the grand *speciosa,* five or six feet high, to the pretty dwarf *virgaurea,* only a few inches in height, growing as an alpine or sub-alpine on all our loftier mountains. The leaves, as we have seen, vary extensively in texture. So do they, as everyone must see, in form, from the broad ones of *latifolia,* to the linear foliage of *tenuifolia* so abundant on Block Island.

Again, the inflorescence or disposition of the flowers varies from spicate to racemose, panicled and broadly corymbose. As to soil again, the location depends wholly on the kind. Some like the queerly named *nemoralis,* very persistent on Warwick plains, grow only in the open and sandy districts, others love to hug stone walls and cliffs. We have seen that one grows only by the sea-shore; others, like *odora,* thrive in open woods; a few climb well up on mountains and one, as we have noticed, crowns the highest peaks.

We hope that in these few lines we have disposed of the idea of *the* goldenrod. There are many and diverse kinds, as there are also of their cousins, the asters. It is their puzzling number and variety that makes them a favorite study of industrious students.

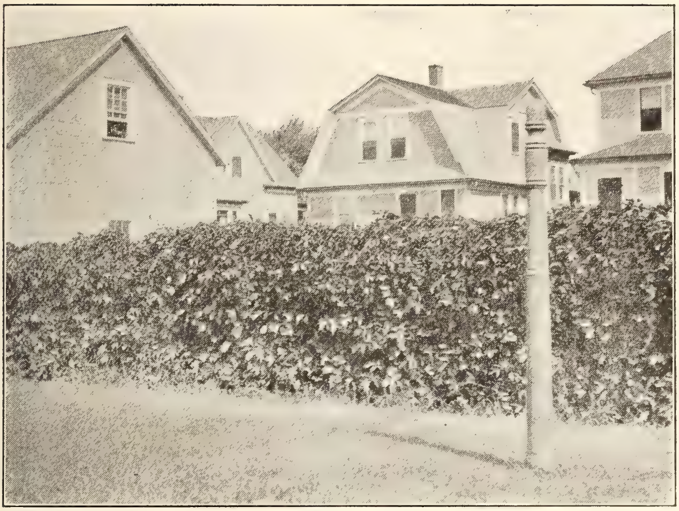
VINE HEDGES

By Willard N. Clute.

IT is usual to make hedges of a variety of shrubs adapted to this purpose ranging from the thorny species like the honey locust, osage orange and barberry to such defenceless forms as the box and privet, but in cases where a support can be provided, excellent hedges and screens may be produced by the use of several of our common vines. Probably the best vine for this purpose is the woodbine (*Ampelopsis quinquefolia*). It is absolutely hardy, grows wild in almost any piece of woodland, and usually may be had for the digging. A few plants will soon make an impervious screen as our illustration shows.

An equally serviceable screen or hedge may be made by any of our native wild grapes. A single plant, when well established, will cover from one hundred to two hundred feet of trellis; in fact the only fault of this plant is that it often grows with such luxuriance that it has to be cut back to keep it within bounds.

The woodbine and the grape belong to the same plant family and both usually climb by means of coiling tendrils. The woodbine, however, like its relative, the so-called Boston ivy (*Ampelopsis tricuspidata*),often has its branching tendrils tipped with adhesive disks which are able to cling to any support with great tenacity. In our common species, aerial roots are often produced, giving the plant still another method of rising above the earth. The woodbine apparently more frequently has adhesive discs in the western part of its range but



The best vine for this purpose is the woodbine.

the two forms may often be found growing side by side. In the nurseryman's catalogue the form which climbs by adhesive discs is usually called the variety *Englemannii*. One of the strong points in favor of *Ampelopsis tricuspidata* is its ability to climb on various objects without assistance from the gardener, but if one is careful to select the right variety of woodbine, it will climb on a board fence or stone wall as readily as the grape will on a trellis.

Of vines that climb by twining, probably the best for screens is the Dutchman's pipe (*Aristolochia sipho*), a plant native to the southern and central parts of the United States. Its broad heart-shaped leaves make a dense shade and on this account it is more often used for porches and arbors than for hedges. The bittersweet (*Celastrus scandens*), is also good for either arbors or screens and has the further fact in its favor that it is covered with its showy fruits in autumn and early winter, but it is apparently not much planted. In the

A hedge of native wild grapes.

books this latter plant is often given the common name of staff tree, but whether because of its use as a staff or because it uses other trees for a staff does not seem to be known. Under normal conditions to call it a tree is absurd. In cultivation, however, it may be pruned into tree form which, when covered with the bright fruits, is highly ornamental.

Any vine to make a good hedge or screen must have a woody stem. Vines with annual stems require too much time to cover the space desired each year. The woody species remain in place from year to year and reach full effectiveness as soon as their leaves are spread.

THE CONSERVATION OF GENERA

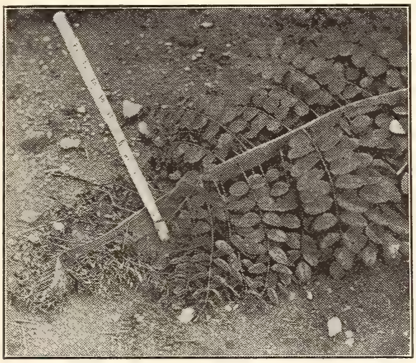
COMPLAINT has been made, bitterly enough at times, of the constant changing of specific names, resulting from a rigid enforcement of the law of priority. In reply, it is contended with some plausibility that such changes will cease automatically when the antiquarian has finally accomplished his task. But there is another source of confusion which has not received adequate attention. Apparently it is regarded as quite unavoidable, or perhaps it is not commonly thought of as a difficulty of nomenclature at all. I refer to the continual changing of names that results from the subdivision of genera. Who has not experienced the peculiar feeling of mingled exasperation and dismay which follows the discovery that some long-familiar genus whose species are to most of us scarcely distinguishable *as species,* has been split over night into half a dozen new genera. In place of the familiar collective group—*Jonesia,* let us say—we now have *Neojonesia, Eujonesia, Pseudojonesia, Megajonesia, Microjonesia* and *Heterojonesia,* or perhaps a set of names that no longer even suggest the former unit. And if we look for the distinctions upon which these subdivisions are based, we commonly find that the differences are very trifling indeed in comparison with the many and detailed points of resemblance between these various groups.

Taxonomists are too prone to regard this whole question of nomenclature as one which is exclusively their own. The intrusion of an outsider into the fray is likely to be hotly resented. I remember venturing, several years ago, to express some of the above views in a letter to a well-known authority on one of the larger groups of invertebrate animals. No reply whatever was made to the line of reasoning set forth by me. I was merely "squelched" with the rejoinder that if I had sufficiently wide experience in describing species I would see things in a different light—a statement which is possibly true though proving nothing as to the point at issue. Our taxonomic brethren have so long been treated as "poor relations" by those who complacently believe their own studies to be concerned with real biology that this sort of a "tu quoque" is now and then to be expected. But such class consciousness should be laid aside and the question candidly considered whether the entire biological profession, or indeed, society at large, does not have a proprietary interest in taxonomic names. A very little reflection will show that this is true. The case is not at all dissimilar to a coal or railway strike in which the rights of the public—the real sufferers—are entirely ignored by the disputants. And we may say with equal justice that the chief sufferers from an unstable system of nomenclature are not the taxonomists—whether "splitters" or "lumpers"—but the hosts of unfortunates who are under the constant necessity of using these names while having no share in their creation or transmutation.

The question raises itself whether the detection of resemblances in nature is not as important as the detection of differences. Is it not largely this unity in variety—or variety in unity—which fascinates the true nature lover, be he an ameteur, beginning student, or professional biologist? And it can hardly be denied that the extent of our recognition of such unity is greatly influenced by the names which we find applied to things.—*From an article by F. B. Somer in Science.*

AN INTERESTING FASCIATION

THE accompanying photograph is a good example of a fasciated branch. It was found on *Amorpha virgata* growing in the shrub collection in the Arnold Arboretum. This branch was the only one on the plant so deformed. In the case of this particular branch, the growth of the crown of the plant was normal, but about a foot away the whole structure started



to flatten out and continued so to the end of the branch, where it seemed to split up into many small immature leaflets. As will be noticed, the branch is approximately an inch and three-quarters wide for a great deal of its length and about one-quarter of an inch thick. The curious way in which the leaves have disposed themselves is very interesting. The bush on which this occurred is a handsome specimen about nine feet high and has a spread of over six feet. The branch is one of the lower ones but with just as much space to develop as the rest on the same level.—*Hubert M. Canning, in Horticulture.*

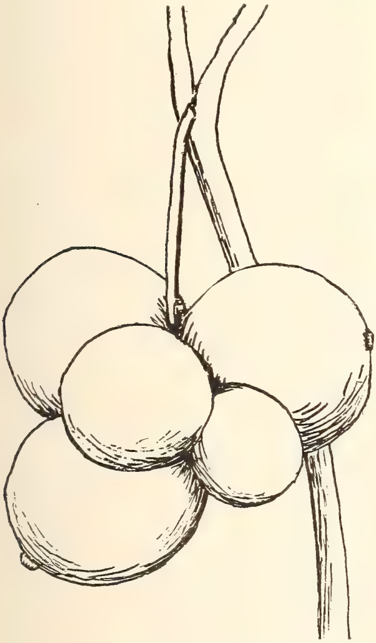
A MAY-APPLE WITH MULTIPLE FRUITS

By Willard N. Clute.

THERE are few flowering plants more abundant in the rich moist woods of the Northern States than the mandrake or May-apple (*Podophyllum peltatum*). Its large umbrella-shaped leaves, sufficiently out of the ordinary to attract the attention of even the non-botanical, and its habit of growing in colonies of considerable extent, make it a familiar plant to almost everybody.

Although so common and well known, few departures from the normal, either in leaves or flowers, have been reported. Occasionally semi-double flowers are found, but in general the plant clings pretty closely to the recognized pattern of its species. It was all the more astonishing, therefore, to find during the past summer, specimens in which the usual ovate, yellow, berry was replaced by a cluster of fruits, each approaching in size the ordinary May-apple. This condition of the plant appears to be extremely rare. With the exception of the 6th edition of Gray, none of the Manuals mention it. In Gray, after the usual description of the species there follows the statement, "Found occasionally with from 2 to 6 carpels," and this statement is accompanied by a mark which indicates that this feature had been verified by the author.

In the specimens under discussion, however, there appears to be some uncertainty as to whether the fruits were produced by several flowers on a stalk or by several carpels in one flower. The fruits appear to be on separate though short stalks and do not have the appearance of crowding one would expect in several carpels ripened from a single flower. The truth of the matter can be ascertained only by a visit to the locality when the plants are in flower, and this must wait for another spring. The locality is so definitely marked, however, that it will be easy to visit again, and we expect to make sure at a later date. In any event, this find carries Gray's observation somewhat further, as we now know that the plant not only may have from two to six carpels in a flower, but, as our illustration shows, several carpels on a single plant may ripen fruits on occasion.



The several fruited form is apparently not an example of mere freakishness on the part of a single specimen for we found a large number of examples in an area several rods square, and assume it to be a common characteristic of the species in the locality. Since the plant spreads rapidly by means of its underground stems or rootstocks, it is possible that all the examples discovered originally came from one aberrant specimen, but if so, this form must have been growing here for a long time. The greatest number of fruits found on one plant was five, but two and three fruits were common. In cases when more than three were found, one or more of the fruits were usually somewhat dwarfed. We are of the opinion that this multi-fruited form is a true elementary species and if in need of a name might be known in future as *Podophyllum peltatum polycarpum.*

THE SPIDERS IN FLOWERS

THE rambler who has time to consider the flowers attentively, may occasionally find a small pale yellow spider lurking in the flower-clusters of various plants. At first glance it may seem harmless enough and even attractive in appearance, but in this case, as in many others, looks are deceptive, and if a specimen is watched long enough, it will be found to be a very lion among insects, lying in wait among the blossoms for its unsuspecting victims and pouncing fiercely upon them as soon as they come within reach. In a recent number of the *Canadian Entomologist,* John H. Lovell has the following account of this remarkable animal:

The Thomisidae or crab spiders have acquired the habit of frequenting flowers for the purpose of preying on the insect visitors. They usually lurk in thrysoid or dense clusters of small flowers like the inflorescenses of sumac (*Rhus*), meadow sweet (*Spiraea salicifolia*), elderberry (*Sambucus*), *Viburnum, Cornus,* and the bristly sarsaparilla (*Aralia hispida*), though they are also found on large individual flowers as the rose. The commonest species of this family is *Misumena vatia,* a white spider with a crimson stripe on each side of the abdomen. It is quite common, but its color will often cause it to be overlooked until a dead insect is noticed lying upon the surface of the inflorescence. Mr. J. H. Emerton informs me that this species and also *M. aletaria* may be either white or yellow and the pink stripes on the sides of *M. vatia* may be either present or absent. Another species, he further states, has red markings and sometimes exactly resembles the sorrel (*Rumex acetosella.*)

Misumena does not spin a web, but conceals itself among the flowers and pounces upon its unsuspecting prey while it is collecting pollen or nectar. On the 16th day of July I had the opportunity to observe the capture of a bumblebee which was gathering pollen on a wild rose (*Rosa lucida*). My attention was for a moment diverted but was recalled by the loud buzzing of the bee. The spider had leaped upon its back and grasped it with its madibles just behind the head. At first the bumblebee struggled violently but so virulent was the poison that its movements speedily ceased entirely. The spider then dragged it over the edge of the flower to the leaves beneath where it dined at leisure.

The temerity and success with which the Thomisidae attack large butterflies, dragonflies, and stinging insects, as wasps, bumblebees, and honeybees, is astonishing. Honeybees are often captured and large flies belonging to the genera *Archytas* and *Therioplectes* and rarely the wasp *Vespa Germanica*. In one case I observed that a small butterfly, *Melitaea tharos,* had been taken. From Framingham, Mass., I have received from Mr. C. A. Frost a number of very interesting specimens together in each instance with the spider by which it was killed. The dragonfly (*Celithemis eponina*) the large butterfly, *Papilio asterias,* and the smaller species, *Colias philodice,* were captured by *Misumena vatia* and the fly, *Desmometopa latipes,* the wasp *Vespa Germanica* and the copper butterfly *Chrysophanus Americanus,* were captured by *M. aletaria.* It is difficult to understand why the spiders were not carried away by such strong-winged insects as the dragonfly and the large butterfly, which so greatly surpass them in size and strength.

The habit of resorting to flowers to capture anthophilous insects and the protective resemblance of coloration must have been acquired by the Thomisidae in comparatively recent times

—that is, since the evolution of flowers and the development of anthophily among insects. The new habit would seem to be the result of observation and experience.

ROSE GALLICA

By Miss S. F. Sanborn.

WHEN I was a child, *Rosa Gallica* grew in my father's garden. I have been anxious to obtain it for mine and have succeeded. One bush, however, bears flowers of a delicate blush hue, instead of the usual deep red and has numerous petals quite warm in texture. The rose was transplanted from a pasture and brought under cultivation near high born plants of the same order. The experience of a neighbor was similar. Two attempts yielded flowers of different colors and as exquisite in finish as any hot-house product.

These facts bear out the statement of Alphonso Wood, who says that this common red rose of our gardens has given rise to not less than three hundred named varieties catalogued as velvet, carmine, York and Lancaster, tricolor, picotee, etc. The plant will be found naturalized in the provinces throughout New England, and as far west as Ohio.

Professor Wood's Manual should be in the possession of every student of the flora of the north-eastern portion of the United States. Some botanists well up in the flora of New Hampshire found a *Potentilla* which was a stranger to them. It proved to be the *Potentilla recta* given in the seventh edition of Gray, but not in the fifth or sixth. Wood, however, described it in his usual graphic style more than forty years ago, disproving at once all inferences one might draw as to its recent introduction.

[Miss Sanborn voices the sentiments of all philosophical botanists relative to the value of Wood's Manual, but the next generation is not likely to know very much about the book, for it has recently gone out of print. It is likely that it may be revised and brought up to date by some modern botanist, but in this case, the interesting notes which Wood was in the habit of tacking on to the more scientific descriptions would be the first to go. A revised Wood's manual does not appeal very strongly to those who know the original.—Ed.]

ARILS.—The aril is a structure seldom given much consideration by systematic botanists, but it is a prominent feature in several plant families and in some cases it is sufficiently valuable to form an article of commerce. Structurally the aril is an outgrowth of the seed stalk which surrounds the seed. A familiar example of this is found in the bittersweet (*Celastrus scandens*), where the bright red and showy portion of the fruit is an aril. The equally brilliant pulpy part of the magnolia fruit also represents this structure. Among edible arils may be mentioned that of the lichee or Chinese nut which, as sold in our markets, is usually of raisin-like consistency, and enclosed in a sort of hull like a nut. Among native arils that are edible may be mentioned the juicy pulp of the May-apple (*Podophyllum*) formed from the arils which surround each seed. In the pomegranate (*Punica granatum*) each seed surrounded by its crimson aril occupies a small cell to itself. Mace, well known for its use in flavoring various dishes, is also an aril, being produced by the same fruit that yields the nutmeg.

NOTE *and* COMMENT

Tulip Growing in America.—It is common for dealers to tell their customers that tulip bulbs soon run out and that new bulbs should be purchased each year if the best results are desired. From the standpoint of the dealer it is doubtless very desirable that flower lovers lay in a new supply of bulbs annually, but as a matter of fact, just as good tulips can be grown in America from good stock as anywhere else, as several growers have already discovered. It is to be understood that when tulips or any other bulbs are forced, either by being grown in water during winter or hurried into bloom while planted in the earth in flower pots, the strength of the specimen is very much reduced, but if tulips are allowed to come into bloom naturally in the open ground and to finish their regular period of growth, they do not run out. On the contrary, they increase in numbers and maintain full sized blooms. There seems to be a regular cycle of development in these plants. When very small bulbs are planted, they commonly do not flower the first season, but make bulbs of blooming size for the following year. After flowering these bulbs develop one or more good sized bulbs each of which will produce flowers in succeeding years. In a good season, however, the bulbs may become too large; that is, they get so big that they begin to develop small bulbs in the axils of the bulb scales and the next season they break up into several smaller ones which must be again planted and grown to maturity as before. The rational way of growing tulips, then, is to plant the good sized bulbs for flowers and at the same time plant the smaller bulbs for growing into flowering sized bulbs, for the following season. When the large bulbs break up, the small bulbs resulting will provide more material from which to make additional flowering bulbs.

PHOTOGRAPHING WITH PLANT JUICES.—*Euphorbia peplus*, a common weed in many places, has assumed a greater prominence in the public eye since it has become known that its juice can affect the photographic plate. The *Scientific American* says that the dried juice will act on a sensitive plate even in the dark. Some of the juice was spread on glass and thus separated from the plate a distance of about three millimeters. Sharp images were found after an exposure of 14 days and faint images were produced in twenty-four hours. Even the inter-position of black paper between the juice and the plate failed to protect the plate, it is reported. At present the cause of this phenomenon is not known. The juice does not appear to be radio active and does not affect the most sensitive electric instruments.

FARMERS AND SCIENTIFIC ADVICE.—The worm seems to have turned in the case of Uncle Silas and the Agricultural Experts. According to *Gardening*, editor Hirth of the *Missouri Farmer*, told a congress of bankers at Chicago recently that farmers generally were failing to receive with much enthusiasm the "Free advice thrust upon them by technical professors from colleges, and boys and girls holding teachers' diplomas in the country schools." Mr. Hirth goes still farther. He is of the opinion that "Agricultural schools as a rule have reached the end of their rope. Half of the people discredit their teachings. We cannot rely upon the bulletins nor technical lectures from technical professors. They are talking to empty benches. Our rural schools are not handled right; they do not give the right kind of instruction that advances the boy and girl of the farm." It may possibly be said with some justice that the Agricultural Colleges have been largely interested in problems not directly connected with advances in farming. Too often investigators have been more concerned with the structure of some plant pest than in measures for its eradication. Analysis of soils and crop rotation have taken precedence of such problems as the improvement of other than staple crops, the selection of varieties fitted to definite locations and the improvement of market conditions. Evidently the farmer is expecting the colleges to get down to business.

THE LARGEST SEED.—There seems to be no question as to which is the largest monocotyledon seed. The double cocoanut, which often weighs thirty pounds, has a clear title to this honor. In the case of the dicotyledonous plants, the issue is not so clear. According to the *Scientific American* the title should go to *Dimorphandra megistosperma*, a tree discovered by Henry Pittier during recent explorations in Panama. Some of the seeds of this remarkable forest tree measured by the discoverer were more than seven inches long and nearly five inches wide.

LONGEVITY OF POLLEN.—The pollen grain is rarely thought of as anything but a bit of fertilizing dust, but it is far more. In reality a pollen grain is a spore, to all intents and purposes similar to a moss or fern spore, and like them capable of giving rise to new plants. But just as the fern spore produces a structure very unlike the plant we know as a fern, so the pollen grain does not produce much of a plant, as common plants go, though its importance is none the less real on this account. Were it not for the sperms produced by the pollen grain plant, the eggs in the plant ovules would miss fertilization and so fail to develop into seeds. It is usual when one wishes to introduce a new variety into a different locality to do so by means of seeds or cuttings, but when the nature of the pollen grain is understood it will be seen that new strains may be introduced into other localities by means of pollen. In recent breeding experiments of the Department of Agriculture it was found possible to ship pollen of grape fruit and tangelos from Florida to Japan and have it arrive in condition to fertilize Japanese species. In previous experiments it was found possible to keep pollen in cold storage for some days, and it has long been known that orchid pollen may remain alive for six weeks or more without special treatment, but the most promising method for the pollen of common plants seems to be that in which the pollen is sealed in glass tubes from which the air has been exhausted. It is likely that future investigators will, by this method, be able to command a much wider range of experiments.

New Forms of Gaillardia.—The blanket flowers (*Gaillardia pulchella* and *G. aristata*) are well known wild flowers often found in cultivation, in which the broad yellow rays are suffused, toward the base, with bright red. In the *Gardeners' Chronicle,* T. D. A. Cockerell has described a variety (*albiflora*) in which the normally bright yellow rays are cream-colored. The form is comparable to *Rudbeckia hirta flavescens,* described in a recent issue of this magazine. Its mention here is to call attention again to the curious way in which yellow and red are grouped on the ray flowers of many Composites, and to indicate their connection with each other as shown in pale forms where the two colors are usually reduced in equal proportions. Seedsmen have developed a large number of forms of both the annual and perennial forms of *Gaillardia* to which they have given grandiloquent trade names, but none seem to have singled out that form of the perennial blanket flower in which the ray flowers are all tubular. This is a very striking departure from the normal and to facilitate reference to it, in future it may be called *Gaillardia aristata* f. *tubuliflora.*

Etymology of Calyx.—The early botanists did not use the word calyx to indicate the outer whorl of floral organs. Their term was empalement. When the word *calyx* came into use it was translated as meaning a cup. Many interesting explanations of the structure of the flower have since been made in which this part of the flower figures as the flower-cup. This derivation of the word, however, seems an error. It is known that the Latin language contains two words derived from the Greek which sound so nearly alike as to be frequently mistaken. One of these is *calix,* meaning a cup or goblet, the other is *calyx,* a husk or shell, that which encloses. It is very evident that it is this latter word which supplied our term calyx. This again illustrates the number of slips there are said to be between the cup and its uses.

Leaf Color in Barberry.—The Japanese barberry (*Berberis Thunbergii*) is one of the landscape gardener's favorite plants. It is a hardy compact little shrub invaluable for all sorts of decorative effects. Though its flowers are not especially conspicuous, the red berries which remain on the plant well into the winter make it of value for the cheerful touch it imparts to the shrubberies long after other forms of beauty have disappeared. Still another of the barberry's good qualities, but one which dealers and gardeners alike have neglected, is the habit the leaves have of turning scarlet in early autumn. Not all plants have this scarlet tinge, however; about half of the individuals in a given planting are likely to have yellow, unattractive foliage. Since the shrub is usually multiplied by cuttings, it would be a simple matter to select for propagation only those whose leaves turn scarlet and thus with little trouble add a new color note to parks and other public grounds. The nurserymen, however, constantly surprise us by their lack of acumen in pushing their products. Barberries are barberries and it never occurs to the grower that a distinctive strain of this plant would be worth more than ordinary. There are too many nurserymen like Wordsworth's Peter Bell, to whom

> "A primrose by the river's brim
> A yellow primrose was to him,
> And it was nothing more."

NECTAR GUIDES OF MILKWEED.—The flattened umbels of the swamp milkweed (*Asclepias incarnata*) may seem at first glance to be simply a number of flowers assembled without design, but a more careful view will show considerable complexity in what appears so simple. It is not mere chance that causes the rose-colored petals to be reflexed at just the angle they hold. Their use is to form a background upon which the white stars of the corona (the "hoods" and "horns" of the books) are displayed. These latter are held just enough above the petals to form a pretty and intricate pattern like a piece of old lace on rose-colored velvet. The nectar, of course, is secreted about the coronas which are held up so conspicuously that any blundering insect may see.

WINTER BOUQUETS.—It used to be the custom in out-of-the-way places to make up bouquets of the less perishable plant forms of the fields and woods for the decoration of the house during the winter. Various feathery grasses and sedges as well as several species of cudweed (*Anaphalis* and *Gnaphalium*) were usually found in such bouquets, together with berries of the bittersweet (*Celastrus*) and the silky plumes of the clematis. The only real flowers in such bouquets were the cudweeds or everlastings, the others being mere seeds or fruits. The cudweeds, however, are not the only flowers adapted for such purposes. There is quite a long list of garden flowers of this character which are popularly called everlasting flowers. In all such the parts of the flower head are so dry, even when the plant is fresh, that further dessication does not change them. The globe amaranths (*Gomphrena*) have flower heads like large purple or white clovers. *Helichrysum* has aster-like flower heads of crimson, yellow or white, and *Xeranthemum* is another genus with heads of a similar shape and color. The coxcombs (*Celosia*) frequently used for decorative planting in parks and gardens, may also be used in winter bouquets, and the far-famed edelweiss (*Leontopodon*) belongs to the same general class. The latter plant is to all intents and purposes a cud-weed and can be grown in gardens as easily as its relatives. For winter bouquets, the flowers should be gathered shortly after they first open and hung up in small bunches, heads down, until dry. Many of them keep their natural colors for years.

New Clematis Disease.—The Government has found out what it is that causes the death of the cultivated clematis. When properly grown the large-flowered species, such as that known to the trade as *Clematis Jackmani,* form very attractive specimens, but they are not as widely used as they might be because of their reputation for failing to survive severe winters. This reputed lack of hardiness now appears to be chargeable, not to the cold, but to a fungus pest which terminates their existence. This has been named *Ascochyta clematidina.* The fungus is supposed to infest all the cultivated species of clematis, but the large-flowered kinds seem most susceptible. A spray consisting of six pounds of sulphur, a pound of laundry soap and fifteen gallons of water is recommended for the control of the pest. Removing the dead growth early in spring and giving the plants plenty of sun and air serve in large measure to prevent the spread of the trouble.

Ants in the Flower Garden.—Not infrequently we hear someone inquiring how to rid their plants of the ants that infest them. This is probably most frequently asked in connection with the peonies which every year are likely to be swarming with large black ants as soon as the flower buds begin to show. It is often inferred that the ants eat the plants but this is a mistake. Their presence is accounted for by the fact that the bud scales of the peony excrete a sweet fluid of which the ants are very fond. Several varieties of ants visit other plants for nectar excreted by leaves and other parts as well as by flowers, but they also visit the plants for the honey-dew excreted by the plant lice, which may often be found feeding on the underside of leaves and on other plant parts. When the plant lice become crowded in a particular location the ants are not above carrying them to fresh fields and so aid in spreading the pests. It will be seen, therefore, that ants, while not harmful in themselves, may become so in spreading other pests. At the same time it may be said that when a plant excretes nectar on its vegetative parts, the ants which feed on it often act as a fairly efficient body guard and drive off other insects. Some of the tropical ant plants were once reputed to produce food for the ants and to have thorns modified for use of ants as shelters in return for the ants officiating as a defensive army, but that there is any direct connection between the supplying of food and shelter to the ants and their protection of the plant is now denied by botanists.

AGE OF TREES.—Inquiries as to the general age of trees have shown that the pine tree attains 700 years as a maximum length of life; 425 years is placed as the alloted span of the silver fir; the larch lives as a rule about 275 years, the red beech 245, the aspen 210, the birch 200, the ash 170, the alder 145, the elm 130. Of the holly it is said that there is a specimen 410 years old near Aschaffenburg, Germany. A count of the annual rings in a gigantic California redwood showed that it began growth in 550 A. D. It was 300 feet high with a base circumference of 90 feet.—*Journal of Horticulture.* [It may be said in this connection that the alder mentioned above is not the American shrub so common along streams in many places, but the European alder which becomes a tree. The elm, also is not our common species, but the species found in Europe, *Ulmus campestris.* Our elm often attains a much greater age.—ED.]

Leaf Skeletons.—In the 18th volume of this magazine we gave several methods of making leaf skeletons. Another method, which may prove useful is mentioned in Horwood's "Practical Field Botany". For this, you make up a solution as follows:

Chloride of lime,	5 ounces.
Washing soda,	6 ounces.
Water,	2 ounces.

The leaves of which skeletons are to be made are to be boiled in a strong solution of this until all but the veins are removed. When the green part of the leaf becomes softened the leaf may be spread on a flat surface, such as a plate or pane of glass and the soft parts washed out by a gentle stream of water. Small and delicate leaves should be simply soaked in the solution. The skeletons may be dried between sheets of blotting paper. A set of leaf skeletons prepared in this way is of more than passing interest. Formerly the only use of such specimens was for making up winter bouquets, but they are now valued for work in botany. No other method shows the veins of plants so well. The specimens may be mounted by gluing them to a piece of black cardboard and protected from injury by a thin sheet of glass fastened to the cardboard by gummed paper such as that used in making lantern slides. If mounted between two sheets of glass in this way, they may be readily examined by holding up to the light.

Potassium and Plants.—The agricultural texts tell us that the three elements needed by plants that are likely to be lacking in ordinary soils are nitrogen, phosphorous and potash. At present, the member of this trio most difficult to obtain is potassium or potash. Almost the entire world's supply comes from Germany and as a result of the European war, our supply has been greatly curtailed. Deposits of potash are rare in this country though there are hopes that deposits of this substance in our arid Southwest may ultimately prove sufficient for our needs. It used to be thought that all soils needed to be supplied with potassium, but a recent publication of the University of Illinois asserts that in ordinary soil the supply of potash is practically inexhaustible; in fact, that a square mile of corn-belt land six feet deep contains more potash than is applied annually to all the farms in the United States. In a single acre, as deep as the plow goes, there are 35,000 pounds of potassium. Analysis of farm crops have shown a potash content that would indicate that a great amount of this substance is needed, but it now appears that plants usually take up more than is necessary for growth. Much of the potash in soils, however, is not weathered out in a form available for plants, but by incorporating with the soil vegetable matter of any kind, the material is made available. All that the farmer needs to do, therefore, is to plow under stable refuse and he may read the war news without uneasiness so far as its effect on the fertility of his soil is concerned.

OBEDIENT PLANT.—One of the characteristic plants of prairie regions is a pink-flowered member of the mint family which botanists know as *Physostegia Virginica.* It is sufficiently attractive to be given a place in the flower garden and most nurserymen offer it under the common name of obedient plant. This name does not seem to have gotten into the botanical books however, for they still list it as lion's heart, or false dragon-head. These names are apparently seldom if ever used. The nurseryman's name is more descriptive, though it is possible that many who are familiar with the plant may be at a loss to understand how it applies. For the benefit of such it may be said that when the plant is in bloom, one may push the individual flowers of a spike about in various directions and they will obediently remain where placed until put in a new position. When the flowers of other plants are pushed about in this way they at once spring back into place as soon as the pressure is released, but the pedicels of the obedient plant are constructed differently. Just why or how they keep the position given them does not seem to have been investigated, but it will probably be found that the mechanism is similar to that which causes the leaves and leaflets of the sensitive plant to change positions when the plant is touched.

Redbud Winter.—Meterologists assure us that there is really no such season as Indian summer. After the first frosts of autumn there may ensue one or more weeks of mild weather which commonly receives this name, but this is not a definite season, though the characteristic weather is well known. In a similar way a cold spell in spring, after winter has apparently vanished, is variously named blackberry winter, dogwood winter, or redbud winter. Our little winter of this kind comes in May and according to the *Monthly Weather Review,* from which these facts are gleaned, is known to weather observers as the May dip. The same season is known in England as blackthorn winter. In Germany it is supposed to come about the middle of May and the four saints, Marmetus, Pancratus, Servatius and Bonafacius, whose days occur at this time are called in both Germany and France by names which mean ice saints. The redbud winter is almost as well characterized as the opposite season in autumn. It occurs at a time when many birds are migrating and often retards the advance of a bird wave until the number of certain species in a locality becomes so great as to be noticeable. Warblers, especially, seem affected by this drop in temperature and many a bird student owes his first acquaintance with the rarer members of this group to a check in their northward movement due to the redbud winter.

Concentrating Grape Juice.—The customary method of concentrating fruit juices is to boil them down, during which process the excess water escapes, leaving the other constituents behind. Boiling, however, often changes the flavors of the fruits and other methods of concentrating the juice are desirable. Recently bottlers of grape juice have taken advantage of the fact that when a watery solution becomes solid, the materials composing it tend to separate, and have proposed to reduce the amount of water in grape juice by freezing. In freezing, the water turns to ice, leaving the sugar and other ingredients as a thick syrup. By this means a gallon of grape juice may be reduced to a quart and at the same time the flavor is not affected. In freezing, also, much of the acid crystallizes out, making the juice less sour and removing the rough taste often encountered in fruit juices. The method of course, is not new. Every boy in the maple sugar regions is aware that if maple sap be allowed to freeze and the layer of ice at the top be removed, the remainder will be much sweeter. In a similar way, vinegar and other liquids containing water may be condensed.

NATURE OF LICHENS.—Almost everybody has a general idea of what lichens are. They are recognized as the grayish-green patches found on the ground, on rocks and on the trunks of trees, fences and the like. Sometimes as in the case of the reindeer moss (*Cladonia*) and the bearded moss (*Usnea*) the plant body or thallus may assume a branching form, though usually it forms a crust-like growth over the object to which it is attached. Lichens are usually found in moist situations or at least in places where the air is moist for a part of the time. They have always been a puzzle to the systematic botanist. They are known to be composed of an alga and a fungus in a sort of partnership, but because they have a recognizable form, some botanists suggest classing them as a separate group of plants. This view of the matter has prevailed until recently, but the tendency now is to class them with the fungi to which they are related. The fungus in the association, it now appears, is not exactly a partner; it is more like a slave-holder that required the algae to work for it. The alga seems only accidentally a member of the lichen community for elsewhere it lives a free existence. Even when removed from the lichen it thrives by itself. The fungus, on the contrary, must have some kind of manufactured food and appears to favor taking it from the alga. If a fungus spore begins germination in the vicinity of an alga colony, it soon captures some of the independent plants and a lichen results. Artificial lichens of this kind have actually been made in the laboratory and grown to maturity. When the lichen fruits it is the fungus and not the alga that is reproduced, though in some groups it is the lichen itself that seems to multiply by producing miniature lichens consisting of a few alga cells held together by a strand of the fungus. The group of fungi to which those of lichens are manifestly related is the Ascomycetes or sac fungi. The black goblet (*Urnula craterium*) and the lilac mildew (*Microsphaeria*) are examples of common non-lichen forms belonging to this group.

Plant Successions.—We are accustomed to think of the vegetation of any particular tract as fixed and settled, but this is far from the truth. After the retreat of the great ice sheet which once covered the greater part of the Northern States, the land was without vegetation of any kind, and it was only little by little that plants came in to occupy it. In most cases there was a regular succession of plant forms, each new group displacing the previous one. This succession was probably different according as the land was sand, clay, or rock. In Coulter's "Plant Breeding," the succession that led up to the white pine forests on the sandy soil of northern Michigan is outlined as follows: "At first there were only a few scattered annual plants which dying, added a small amount of humus to the sand. When sufficient humus had accumulated the heath formation came in. The plants of this formation are the huckleberries and allied plants. During this period the ground was so completely covered that competition of plant with plant began. The continued accumulation of humus finally made the pine forest possible and young specimens of this tree began to appear. The first pines were jack pines. These were sooner or later crowded out by the Norway or red pine, and these in turn gave way to the white pines. At this stage of the proceedings man happened along and cut down the pines. Had he not interfered, the white pines would not have been able to hold the ground for long. The white pine forest is not self-perpetuating. The seedlings do not grow well in the dense shade of their elders, though this shade is acceptable to young maples, beeches and other broad-leaved trees. In consequence the ground under the pines was covered with broad-leaved seedlings and when the pines died they were replaced by broad-leaved trees. These latter form the climax formation of vegetation for the region. In other regions the climax formation may consist of grasses but until the climax is reached, one plant group after another must give way to the advancing plants."

Flowers as Specific Characters.—In classifying plants the important characters are practically always taken from the flowers and fruits. Of course there are many distinguishing characters taken from the leaves, stems, roots, and other plant parts, but the principal ones are furnished by the flowers. The reason for this is that flowers are less likely to vary than other parts of the plant. All the activities of plants and animals may be grouped either as growth or reproductive processes. Growth may take on a variety of forms depending considerably upon the location and opportunities of the individual, but reproduction is not so easily modified and the reproductive organs are therefore less likely to vary. As a consequence, when any noticeable difference occurs in these parts, it is likely to indicate considerable differences in the whole organism. When man first began to classify plants, he seems to have been inclined to classify them by their vegetative parts. A favorite division, which has not yet lost its value for some purposes, was into herbs, shrubs and trees. Such a division, however, often separates closely related plants. It was probably quite by accident that the flowers began to be used as distinguishing structures, but time has confirmed the value of this method and it is not likely to be abandoned.

Flower Colors Mixing.—One of the ideas most difficult to eradicate from the mind of the average individual, is that flowers of different colors, when planted together, will mix. The whole matter of cross pollination is still a mystery to him. Having heard that plants cross, or mix, in some way, he assumes that it is the plants that affect one another. In some cases he even goes so far as to imagine that plants of widely different relationships can thus affect each other. As any botanizer knows, however, plants of the same species with various colored flowers may be grown intermingled for long terms of years, without the least fear that the colors will mix. If the plants are annuals or other short-lived plants that have to be reproduced from seeds, however, this is quite another matter, for in seed production, the flower has to be pollinated, and if the pollen from a flower of one color falls on the stigmas of a flower of another color, a mixed progeny will of course result, though this is often not manifested in the plants of the first generation. Tulips, hyacinths, nasturtiums, sweet peas, pansies and many other plants with multicolored flowers may be planted in close juxtaposition without any change in the flowers whatever.

Growth and Reproduction.—Plants as well as animals are made up of small bits of protoplasm called cells, and all growth consists of the division and subsequent increase in size of such cells. In the lower forms of life any cell may thus divide, but in higher forms it commonly happens that only certain cells are concerned in such activities. In the trunks of dicotyledon trees, for instance, the chief growing tissue is the cambium layer situated between the wood and the bark. In the simplest plants, which consist of single cells, growth and reproduction are practically synonymous since when the cell divides in growth, it forms two distinct individuals. When the organism consists of many cells, division may result merely in growth, but if one or more of the new cells produced become separated from the original colony and form new individuals; this is reproduction and the beginning cell is a spore. In higher plants, a union of cells may precede division. This is what happens in flowering plants when one of the sperms produced in the pollen tube unites with the egg cell in the young ovule in the production of a seedling by subsequent cell division. So long as conditions are favorable, the divisions that merely result in growth proceed rapidly, but when unfavorable conditions arise, the protoplasm especially in one-celled forms, shows a disposition to draw together into a roundish mass and to cease dividing until better days come. Such bits of protoplasm known as spores serve to distribute the species, as well as to tide them over unfavorable seasons. For this reason, probably, flowering plants are inclined to bloom whenever anything occurs to threaten their continued growth.

WATER LILY APHID ON PLUM.—Nature usually arranges matters so that there is always sufficient plant pests to go around. Pond lilies, water lilies, and other aquatic vegetation are protected from many enemies by the medium in which they live, but even in the water they do not entirely escape the plant lice or aphids. There is one species that preys on the water lily, cat tail, and water plantain, which seems particularly designed to bother water vegetation, being equipped with waxy areas which prevent it from getting wet if it happens to fall in while feeding on aquatic plants. The interesting thing about this aphid, however, is the fact that it also feeds on the plum, being one of the most destructive of the insects that bother that tree. It is a migratory species living on the plum until hot weather comes and then going to its home at the lakes until the temperature moderates. Then back it goes to the plum where it deposits the eggs which last through the winter and hatch out new colonies the following spring.

EDITORIAL

The well known scientific magazine, *Popular Science Monthly,* has recently separated into two distinct publications, and in announcing the change, the editor makes some observations regarding the support given to scientific magazines generally, that is worth pondering by all interested in any branch of science. According to our authority the American people do not care enough for sound and reliable scientific information to pay what it is worth. They are content with the pseudo-science of the daily paper and an occasional sensation of doubtful value in the monthly magazines. Practically every serious publication in the United States devoted to giving scientific news and information to the non-technically educated citizen has lost money, is still losing it and must continue to do so, in the opinion of this critic, if they are to continue existence. There are over a hundred journals and proceedings devoted to the publication of research work in America, not one of which pays its expenses on a regular business basis. Each year they show a deficit which must be made good by individual contributions or the backing of some responsible organization.

The *American Botanist,* while in the same general class as the publications mentioned, is in some respects more fortunate. It is the only botanical publication in North America that is not subsidized and yet has never had a visible deficit. By this latter phrase we mean that it has always earned enough to pay all bills demanding real money, but if the debt it owes to contributors and the editor was estimated in such terms, the sum would look like a new war loan. At present, contributors are paid in thanks, extra copies, subscriptions and some cash, while the editor is supposed to be well repaid for more hours of strenuous labor than he cares to contemplate, if the magazine comes out on time. If any botanical editor in America is paid for his work the money comes from outside sources. Under such conditions the scientific magazines can hardly be expected to appear as regularly, or spend money as lavishly, as their literary contemporaries. In every case the editors and publishers have to make sure of sufficient income from other sources to supply their daily wants before they can think of such expensive luxuries as scientific magazines. That some of these dependent publications have been running for a score or more of years, speaks well for the devotion of the editors to science, but doubtless a little more encouragement in the way of subscriptions would add to the fervor of their devotions.

BOOKS AND WRITERS

Interest in the Iris seems to be on the increase; at least it has made a second edition of Harrison's "Manual on the Iris" desirable. Like the first edition, this contains a large amount of information on the cultivation and propagation of the iris, interspersed with many naive comments of the author. The booklet ends with a list of the varieties in cultivation. It may be had from C. S. Harrison, York, Nebr., for 25 cents.

Probably less is known about plant galls and their causes than about any other phase of botany. There are various works on British and other Old World galls to be had, but there seems to be no book, either scientific or popular, on the galls of this side of the world. A contribution to the subject has recently been made by the issue of an "Illustrated Catalogue of American Insect Galls" by Millett Taylor Thompson, which was edited and published after the author's death by E. P. Felt, State Entomologist of New York. The catalogue contains 21 plates showing nearly 200 examples of galls and all the forms common in America are listed; first, according to the plants they infest, and then by the genera of insects which produce them. The addition of a little more explanatory text would have made this a most useful work. As it is, anyone interested in galls will be glad to have it. It is distributed by the Rhode Island Hospital Trust Company, Providence, R. I.

"Continuous bloom in America" is the somewhat disappointing title of a new book by Louise Shelton. From its title, the amateur might jump to the conclusion that the secret of how to make the garden produce flowers from spring till fall has been discovered, but the text does not bear out the inference. The first few chapters are devoted to when, where, what and how to plant, with much discussion of the proper way to set plants in beds and borders to secure the end in view, and about a hundred pages are given to a list of desirable plants with cultural notes, but the list is sadly lacking in any but the common varieties. In the day lilies (*Hemerocallis*), for instance, only one of the half dozen desirable species is mentioned. For this reason, however, the book may appeal to the novice who commonly does not know the more desirable, if rarer, sorts and may not wish to be confused with such information at the outset. There is a marked lack of uniformity in the use of plant names; in some cases the scientific and common names being used indiscriminately in the same list. The scientific names are often curiously abbreviated, as *Mertensia vir.* and *Veronica subsess.* Occasionally, also, the specific names are used for plants without a hint as to the genus to which they belong. There are sixteen excellent illustrations of gardens, and while the text is sometimes lacking in details, it is correct and therefore useful. The book is published by Charles Scribners' Sons, New York, at $2.00 net.

"The Book of Hardy Flowers" by H. H. Thomas, comes very near realizing the gardener's ideal of a complete book of information about plants. It is really a dictionary in which the plants are arranged alphabetically, followed by notes which give a description of the plants, the extent of the genus, time of flowering, color of the flowers, the soil and exposure favored, whether hardy or tender, annual or perennial, the pruning required, methods of propagation and similar matters. All the desirable varieties in cultivation are noted. To contain this information nearly 500 pages are required. There are also 64 plates in black and white and 32 others reproduced by direct color photography. The book, like so many other good things in gardening, comes from England, and this must be kept in mind when such subjects as hardiness and exposure are mentioned. Many things hardy in Great Britain are not hardy in our Northern States. It is also doubtless owing to British influence that the term "Natural Order" is used for what we in America know as a plant family—the Liliaceae, for example. The book should form part of the foundation of every good gardener's library. We do not know of a more useful amount of information anywhere. The book is published in this country by Funk and Wagnalls, New York, at $3.50 net.

Directions for the study of horticulture by the laboratory method are still among the rarities, and in consequence George W. Hood's "Laboratory Manual of Horticulture" published by Ginn & Co., should find an appreciative audience. While the number and extent of the exercises outlined will doubtless prevent the use of the book entire, the wide awake teacher will find a considerable number that can be made a part of even high school courses. The last forty exercises, dealing with studies of individual fruits impress us as scarcely worth while in studies of this kind. There are numerous good illustrations and an adequate glossary. The book costs $1.00.

In the old days students of plant anatomy were content with sections cut with a dull razor, but the advances of botany have made necessary a more refined technique until now, according to Dr. Charles J. Chamberlain, author of "Methods in Plant Histology", the pollen grain of the lily, which, placed upon a dark background, is barely visible to the naked eye, can with modern methods be "cut into fifty sections, the sections can be mounted and stained, without getting them out of order, a photomicrograph can be made from the preparation and a lantern slide from the photograph, and finally there appears upon the screen a pollen grain ten feet long with nuclei a foot in diameter, nucleoli like baseballs and starch grains as large as walnuts." Dr. Chamberlain's book is intended to introduce students to the modern methods which make such performances possible, and the fact that this is the third revised edition indicates that it is meeting the requirements. There are more than 300 pages in the present edition which begins with general directions for sectioning, staining and mounting, with a chapter on lantern slide making, and ends with special directions for work in all the plant groups. A large number of illustrations explain the text and incidentally supply examples of what may be done by the methods described. The author has not made the mistake of assuming more knowledge on the part of the pupil than he actually possesess and the directions in consequence are clear enough for the novice to assimilate. A valuable feature of the book is found in the comments of the author which are lucid, sensible, and always interesting. The book is published by the University of Chicago Press at $2.25 net.

A large number of botanists—possibly all of them—were interested in birds before plants claimed their attention, and many still retain their interest in ornithology. To all such the biography by William H. Dall, entitled "Spencer Fullerton Baird," should prove of unusual interest. Like his friend, Louis Agassiz, Baird was a born naturalist, interested in all phases of nature, though with a strong leaning toward the birds and fishes. His best known work is "The Birds of North America," issued in collaboration with Brewer and Ridgeway. He will probably be longest remembered, however, for his work in connection with the Smithsonian Institution and the United States Fish Commission. Of the first, he was for a long time the Chief and the second was organized under his direction. The story of his life is told in this volume largely by excerpts from letters written to and by him, with sufficient comment by his biographer to fuse the references into a coherent account. Nearly as interesting as Baird's biography is the light the book throws on the characters of the early ornithologists, most of whom corresponded with Baird at one time or another. John Cassin especially must have been a man worth knowing. Accompanying the text, which covers 450 pages, are nineteen photographs, mostly likenesses of various members of the Baird family. The book is published by the J. B. Lippincott Company, Philadelphia, at $3.50 net.

The Comstock Publishing Company of Ithaca, N. Y., is issuing a series of note-books for the study of birds, trees, fish, and the like, that seem to be meeting with considerable favor. The books are bound in stout paper covers and fit easily into the pocket, ready for notes at any time. The tree-book begins with outline drawings of the leaves of nearly 100 trees, and the student is expected to identify his specimens by comparison with these drawings. Then follow enough four-page outlines for notes on each tree. The notes call for various data regarding the shape, bark, leaves, flowers, and fruits of each specimen studied. There is also a key to the evergreen trees with outlines for notes. There are two bird note-books, each containing 25 or more line drawings of birds by Fuertes, and enough outlines for describing the bird, its song, habits, nests, eggs, and young. The labor of note-taking is lessened by lists of words which may be underscored to indicate various features. The arrangement of the note-books is the work of Mrs. Anna Botsford Comstock. Such books should be a great help to beginning students. The price is 30 cents each.

F. Schuyler Mathews' well known "Field Book of American Wildflowers" now has a Western analogue in "Field Book of Western Wildflowers", by Margaret Armstrong and J. J. Thornber. This is the first attempt to make a handbook of the common flowers of the entire West exclusive of the Rocky Mountain region. It is certain to prove of much value to all interested in the plants in the region covered. In addition to a descriptive text including both genera and species there are 500 line drawings and 50 colored plates by Miss Armstrong. The book could have been made several pages shorter if the statement that "There are many other kinds of this" had been omitted after each genus. It is published by G. P. Putnam's Sons, New York, at $2.00 net.

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WILLARD N. CLUTE, EDITOR

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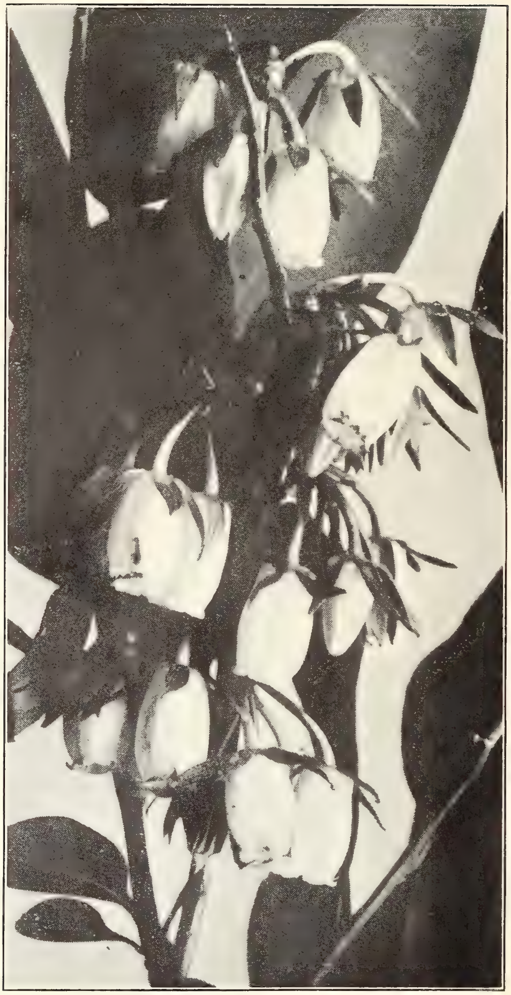

Stagger-bush.—*Pieris mariana.*

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He is happiest who hath power
To gather wisdom from a flower
And wake his heart in every hour
To pleasant gratitude.
—Wordsworth.

HEATHS AND HEATH PLANTS

BY WILLARD N. CLUTE.

IN Old World song and story, the words heath and moor are frequently used to denote certain stretches of wild uncultivated country but their usage in this respect is so varied that it is probable that many persons have but a hazy idea of what either a heath or a moor is like. The researches of the ecologist, however, are rapidly giving these words a definite meaning, not only to the plant student but to others as well. There are at least four types of uncultivated or uncultivable land to which man has given distinctive names. These are marsh, fen, moor, and heath. When the terms are properly applied they indicate very different types of country.

The moor is what we, in America, are more likely to call a peat bog, or sometimes merely a bog. It is always underlaid with peat, the soil has an acid reaction and the vegetation it supports is of a peculiar type in which plants like the sundew, pitcher plant, buckbean, huckleberry, cranberry and other plants which avoid lime, predominate. The marsh is a watery waste without peat—what is commonly called a swamp. When such a marsh is formed by filling up the shallow water at the mouth of a river by material brought down by the stream in times of flood, the English call it a fen. The lands in the lower Mississippi valley might properly be called fens. The fen may or may not contain peat but it always differs from the moor in this important particular: the soil is always alkaline and not acid. It therefore supports a very different set of plants from those of the moor, among which, coarse grasses, sedges, cattails and the like may be found.

The heath is a dry and sterile region that nevertheless partakes somewhat of the character of the moor. Like the moor it has a peaty soil with an acid reaction which explains why some of the common plants of the moor may be found on the heath as well. Though heaths are characteristic of dry regions, they seldom develop in limestone countries and when they do, it is always in situations where the soil lacks lime.

The heath has long been known by the name it bears; in fact, there must have been heaths before there were heathen. The heathen, however, are not alone in deriving their name from the heath: the characteristic plants of the region are also heathen or, rather, heaths, which is merely a different form of the plural. Originally, any plant which grew on a heath was called by this name, but in later days the term has been reserved for the members of a great plant family known otherwise as the Ericaceae. In Europe, the principal heath plant is the ling or heather (*Calluna vulgaris*), though with it there are usually associated two species of *Erica* which are also called heather on occasion. Two heaths related to our blueberry—*Vaccinium myrtillus,* called bilberry or whortleberry in Britain and *Vaccinium vitis-idaea,* the cowberry or lignon berry—are also usually abundant. The fruit of the latter is regularly exported to the United States.

In South Africa as well as in our own part of the world, the drier regions are characterized by an abundance of heathworts.

In Africa, the genus *Erica* is represented by numerous species, but with us this genus is absent, its place being taken by numerous blueberries, hucklebebrries, andromedas and the like, not to mention species with less of the conventional heath-like aspect, such as wintergreen, shinleaf, arbutus, bearberry, and kalmia.

The typical heath flower, at least the typical flower of the heath genus, *Erica,* has a narrowly bell-shaped corolla slightly contracted at the throat—a form which the botanists call urceolate. Many of our heathworts closely follow this pattern of flower. It is especially prominent in that group of plants once placed in the genus *Andromeda* but now scattered through such genera as *Xolisma, Pieria, Lyonia* and *Leucothoe.* One of the handsomest of these is *Andromeda mariana* or *Pieris mariana,* shown in our frontispiece. It is a common species in the sandy soil of the Atlantic Coastal Plain from Long Island to Florida. Its common name of stagger bush alludes to its reputation, which it shares with several other heaths, of producing poisonous honey. In localities frequented by this heath

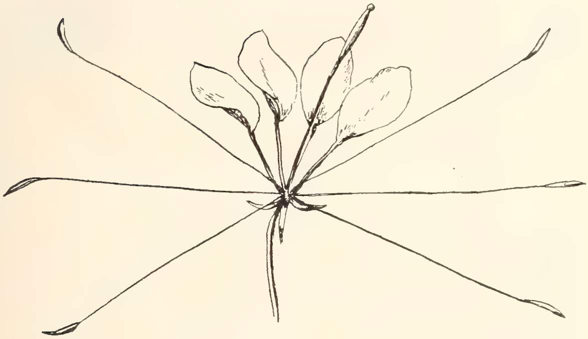
A form which the botanists call urceolate.

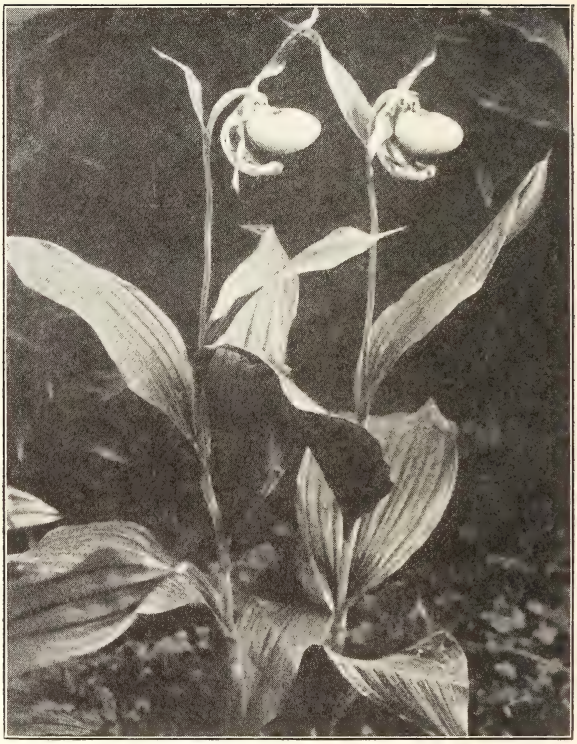
one may often find a trailing species, the bearberry (*Arctostaphyllos uva-ursa*), its long stems thickly set with substantial glossy green leaves forming bright mats of verdure on sandy knolls, bare otherwise. Although it is apparent from the spelling of the generic name that the common name is rightly spelled *bear*berry we have always felt, in view of the region it affects and the dry and tasteless nature of its fruits, that it would be more appropriate to spell the name *bare*berry.

A Southern species of Andromeda.

As one proceeds southward, the species of *Andromeda* increase in number while other heathworts, not found in the Northern States, begin to appear. Several of these are moor plants, rather than true heath plants from which it is evident that acid soil rather than any predilection for heath or moor, influences their location. In the North, many of the heathworts also inhabit the moors. The little leatherleaf (*Andromeda calyculata*) whose persistent, russet-leather leaves are conspicuous above the snow in winter is fond of skirting the edges of cranberry bogs, and the marsh rosemary (*Andromeda polifolia*) with substantial evergreen leaves and revolute margins may be found in the same places. The cranberry, it may be remarked in passing, is also a heath that prefers the moors.

In addition to the heatworts proper, there are of course a large number of other plants which grow with them but such species are rarely ever abundant enough to form a dominant part of the flora. Second only to the heaths are likely to be the representatives of the pea family—*Baptisias, Cassias, Tephrosias, Desmodiums, Lespedezas* and the like—that thrive in sterile soil. Various grasses and sedges are usually present, but the heathworts prove their right to the name by maintaining their supremacy in the face of all competition.





A FREAK LADY-SLIPPER

By Raymond L. Fedder.

WHILE on an excursion with my brother to a distant and, to us, unknown piece of woods, last Decoration Day, we discovered a peculiar form of the lady-slipper (*Cypripedium*) with what might be called a double flower. In this the lower sepal is developed into an extra shoe-like part of the same texture and color and with the same brown markings on the inside as in the usual flower.

I believe this freakish form has become fixed in some of the plants, as there were two specimens growing together with this peculiarity and another nearby. The buds had not opened when we found them so we carefully dug up the plants and transferred them to our home where they developed perfectly into quaint flowers of surpassing interest. I photographed them on June 9th. The pictures will give a clearer and better idea of them than any description can. The species represented is the smaller yellow lady-slipper, *Cypripedium parvulum*.

[Good illustrations of plant freaks are always worth preserving; in fact, we rarely publish anything of this nature without receiving requests for further information from various parts of the world. We hope Mr. Fedder will keep watch of this plant during succeeding seasons. It will be interesting to know whether the peculiarity noted will persist as so many freaks do.—Ed.]

LATEX

By Willard N. Clute.

HERE and there, among the plants of field and forest, one comes upon specimens that, when broken, yield, not the colorless sap naturally expected, but a sticky white fluid much resembling milk. This substance is technically known as latex from *lac* the Latin word for milk, and the plants that produce it are often called milkweeds. Latex, however, is far from being defined as a white fluid. A majority of laticiferous plants have a white latex, to be sure, but the latex of bloodroot is red; that of celandine, orange; that of horned poppy, yellow; while the latex of the California poppy is clear and colorless. Among the mushrooms we find still more brilliant colors. In the genus *Lactarius* named in allusion to the milky juice possessed by many species, we find sulphur yellow, brick-red and vermillion latexes, and in one species the milk is actually dark blue. It is interesting to note in this connection that no plant has a green latex, common as this color is in other parts of the plant.

Latex-bearing plants are not scattered promiscuously throughout the plant world. Many plant families have no laticiferous members but when latex occurs at all, it is quite likely to be found in all members of such a group. Nor are laticiferous plants very abundant. Among the fungi the phenomenon is confined to the genus *Lactarius* and a few of the shelf fungi, such as the sulphur polypore, and in flowering plants less than a dozen families of plants possess it. The best known are the spurges (Euphorbiaceae), the dog banes (Apocynaceae), the dandelion or chickory family (Cichoriaceae), the poppies (Papaveraceae) the bellworts (Campanulaceae), the sumachs (Anacardiaceae), the banana family (Musaceae) the Breadfruit family (Artocarpaceae), and the milkweed family *par excellence* (Asclepiadaceae). Most of these adhere pretty closely to the production of a white juice, the mushrooms and poppy-worts being the principal ones to exhibit different colors.

It is a singular fact that all the composite flowers constructed on the plan of the dandelion, that is with heads consisting entirely of ligulate flowers, have latex, while those with ray and disk flowers like the sunflowers, and those with tubular flowers like the thistles are without it. A few years ago, all the composite flowers were placed in one great group, but they are now regarded as constituting several closely related families. Those who believe that the dandelion-like flowers should be placed in a separate group may well adduce the possession of latex as an additional reason for the separation.

In laticiferous plants, the latex may occur in any organ of the plant from the roots to the flowers and it may be present in one part and not in another. Latex is not, as some suppose, identical with the sap of plants. Latex tubes have no connection with the fibrovascular bundles through which the food and moisture-bearing tubes extend. They run in the same general direction as the tubes in the bundles, but they are usually found in the cortex of the plant stem and not in the central cylinder. They differ from the tubes of the bundles in another respect—they branch extensively and often form irregular networks in the parenchyma. As to origin there are two different groups. One group consists of single cells that become extensively branched and push their way between the parenchyma cells much as the pollen tube finds its way down through the style. In this case the latex has been likened to the cell sap in a single immense opening or vacuole. Such latex cells are common in the spurges, dogbanes, and milkweeds. In other plants the lacticiferous vessels are formed by the fusion of several cells. This type is found in the dandelion. In most, possibly in all forms, a thin lining of protoplasm is found in the tubes. The walls of the tubes, themselves, are thin and soft and, being surrounded on all sides and pressed upon by the turgid cells of the parenchyma, are quickly emptied of their contents when the tissues are ruptured.

Latex has been described as a watery fluid with suspended granules, but it is more than that. It may contain sugar, starch, salts, acids, oils, gums, resins, tannins, rubber, alkaloids and proteids; in fact, nearly every substance secreted by plants is likely to occur in it. For this reason latex tubes are often regarded as organs for the storage of reserve food. Opinion as to their use, however, is divided. Some botanists regard the latex as simply an execretion, others consider it designed for the protection of the plant, and still others hold that it assists the sieve tubes in transporting the food. It was once thought that there is a circulation of latex in the tubes, but this is now regarded as an error. It is quite possible that latex serves a different purpose in different plants and that all the views held concerning it are in a measure correct.

When latex is exposed to the air it soon coagulates, forming a sticky, elastic mass, and its value in closing the breaks in plant tissue are obvious, but the stories of its repelling insects by being sticky are largely overdrawn. According to Kerner, the ants are unable to climb the milkweed stalks because their claws puncture the stems and the latex holds them fast, but observation in the nearest milkweed patch will show plenty of ant visitors in no way bothered by the latex. The sticky latex may deter some insects from eating the foliage but others do not appear to mind it. The latex of many plants contain active poisons and these, of course, may protect the plants from leaf eating animals of any kind.

The many substances contained in the latex make it frequently of use in medicine. Bloodroot and lobelia are valued as emetics and expectorants, the argemone or prickly poppy, and even the endive, is prescribed for jaundice, the juice of the celandine is reputed to be a remedy against warts and the itch, and the rattle-snake root is so named because its juice is regarded as an antidote for snake bites. Opium, which is the dried latex of the poppy, and medicines derived from it, are said to be more frequently prescribed than any other drug. The same substance, though in lessened quantity is found in the juice of the common garden lettuce. It is possible that most of the oyster-like flavor of the salsify and scorzonera are due to the latex.

In tropical lands, many trees and vines belonging to the milkweed, fig, spurge, and dogbane families yield an abundant latex containing caoutchouc. This being first brought from India and used for erasing was known as India rubber or gum elastic, but at present it is known simply as rubber. A poor grade of rubber has even been extracted from our common milkweed. Gutta percha, which is similar to rubber is also derived from the latex of some species.

The fig or breadfruit family (Artocarpaceae) which is widely distributed in the tropics and is represented with us by the mulberry, and osage orange, is one of the most interesting of the laticiferous plant families. The bread fruit tree gives both bread and milk though the bread, while edible, is scarcely bread in our sense of the word and the milk is unfit for use. With so many species of latex-bearing trees, it would be surprising if none were found to yield a fluid fit to drink. As a matter of fact the south American cow tree (*Galactodendron utile*) when tapped yields large quantities of milk that is said to be sweet and delicious. Not all members of the fig family are equally harmless, however. One of the deadliest poisons known is derived from the latex of a species known as *Antiaria toxicaria* from the East Indies. This is the so-called "deadly upas tree." It was once regarded as so poisonous that people who sat in its shade or the birds which perched in its branches speedily fell dead, but this tale is now known to be a work of the imagination. The writer has spent hours in the shade of the largest upas tree in the western world without any ill effects whatever.

LIVERWORTS

By Dr. W. W. Bailey.

ALMOST, if not quite, coincident with that of trailing arbutus is the coming of hepatica or liverwort. In Rhode Island, it is a local wild flower though abundant enough when once found. I have never been able quite to account for its distribution. One naturally turns to soil, to geological formation, or to topography for an explanation, yet in some one or more of these factors there is ever a failure to account for the facts. Thus, while in this State it is frequently found in a limestone formation, where I first knew it as a child, in the Hudson highlands, it grew among granite bowlders and pebbles. Even here, I am inclined to think, it does not confine itself to lime.

It possesses, along with trailing arbutus, the habit of hiding itself amidst fallen leaves, the coy flowers usually appearing well in advance of the foliage. Yet the last year's three-lobed leaves, now bronzy or purplish, generally accompany the blooms and very shortly one detects the new leaves neatly folded, or better, rolled inward, glossy green in their young state and clothed with silky hairs.

It is one of those plants that depends upon its calyx, rather than upon its corolla for its beauty. Indeed, it presents in this respect some deceptive features. At a varying distance from the white, pink or violet sepals appears three ovate bodies often so near the flower as to resemble a calyx. These are really bracts and are often remote enough to be recognized as such.

The eight to ten or more sepals are all distinct, somewhat elliptical in shape and early deciduous. There are numerous stamens and pistils, all distinct. These features and the insertion of the parts on the receptacle, i. e. beneath the pistils, help to identify the plant as one of the multifarious group of crowfoots or plants of the buttercup family.

As is well known, this family possesses strikingly dissimilar members which yet possess marked characters, like those mentioned above, by which one learns to know them. Thus it may have both calyx and corolla or one circle of floral envelopes, only, when it is always the calyx which is present. The petals, if there are any, may be long and spurred as in the columbine, or curious sacs as in goldthread or indiscribable bodies, as in larkspur and monkshood. The simple pistils usually free from each other are a marked feature as in our liverwort, but in the peony they are more or less united.

The name, liverwort, and its Latin equivalent, *Hepatica,* was given to our little plant from a fancied resemblance in the leaves to the form of the liver. There followed from this, by the ancient doctrine of signatures, a belief that the foliage was useful in complaints of that organ. I fancy it may be used, even now by some persons with this idea in view. It is probably no longer found in any authentic pharmacopeia, but of it might be said what Asa Gray said of some other plant, "It is probably as efficacious as many other things."

THE WOODEN PEAR

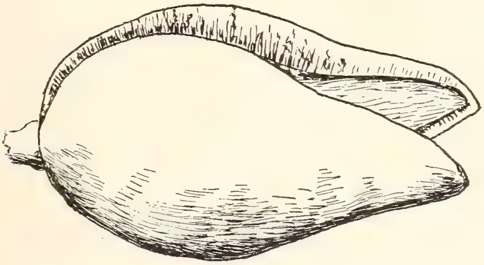
By Willard N. Clute.

RETURNED travellers used to be fond of asserting that Australia is a land of opposites in more than a geographical sense, adducing in support of this proposition the fact that in that faraway land pears grow with the large end nearest the stem. Better methods of communication long ago put an end to such mild attempts at nature-faking and in the case of the pear, at least, revealed the basis upon which its myth was constructed.

As a matter of fact, pear-shaped fruits are found in Australia with the stem at the large end, but they are not the kind of fruits we ordinarily visualize when pears are mentioned. Though in size and shape the foreign pears are very good likenesses of our well known fruit, the likeness goes no further, for the Australian products are of solid wood and about as enduring specimens of fruit as can be found anywhere. The common name of wooden pear exactly describes them.

The wooden pear is the fruit of a tree, *Xylomelum pyriforme,* belonging to the Proteaceae, a large tropical and subtropical family of trees and shrubs most abundant in Australia and South Africa, but represented by a few species in the American tropics. The fruit is a follicle, similar to that which ripens into a milkweed pod, and like other follicles, splits down the ventral suture at maturity, allowing the seeds to escape. In our plant there are two roundish seeds pressed face to face, and each provided with a papery wing by means of which it sails away on the wind.

The nearest relatives to the Proteaceae in our flora, are probably the true laurels—sassafras, spicewood and the like. The Proteaceae usually have four parted flowers lacking a corolla and otherwise so variable that this feature has suggested the scientific name from Proteus, a character in Greek mythology famous for the number of different shapes he could assume. The silk oak (*Grevillea*) often seen in cultivation in the warmer parts of this country is a member of this group.



Like other follicles splits down the ventral suture.

VEGETABLE CHIMERAS

VEGETABLE chimeras, known also as graft hybrids, are plants of a hybrid nature, which, however, have not arisen through seed production, but as adventitious shoots springing from the callus formed at the junction of stock and cion in grafting. Two classes of chimeras are recognized, sectorial and periclinal. In sectorial chimeras the tisues of the two parents or members, stock and cion, are united side by side in the growing point so that the parts of the chimera resembling the respective parents may be separated longitudinally. A periclinal chimera is one in which the center of the plant consists of tissue of one parent overlaid by a layer of tissue of the other plant from one to two or possibly more cells in thickness. In the latter case, the individuals may often bear the most striking resemblance to real hybrids, being complete blends between the two parents in both vegetative and reproductive parts.

Chimeras have been known for about 270 years. Probably the first on record was produced in Italy in 1644 between the orange and citron the fruit resembling an orange with a section of citron. Such fruits were called bizarrias because of their peculiar appearance. In recent years, similar chimeras have been reported as originating in Florida between the orange and grape fruit. A very beautiful chimera of recent origin is that of an apple produced by Prof. W. E. Castle of the Bussey Institution by grafting a "Boston stripe" upon the "golden russet". In this case, the stem end half of the apple is russet while the blossom end is of the "Boston stripe". Among the more famous chimeras or graft hybrids may be mentioned the much discussed *Cytissus Adami* which originated near Paris about 1826. This was said to have been produced as the result of a graft between *Cytissus purpurea* and the common laburnum or golden chain (*Cytissus laburnum*). Another is the White-thorn medlar (*Crataego-Mespilus*) which is said to have originated near Metz, Germany, by grafting the white thorn (*Crataegus monogyna*) upon the medlar (*Mespilus Germanicus*). As the above mentioned species do not cross, the origin of these wonderful and perplexing forms remained a matter of speculation until a few years ago when Professor Hans Winkler produced chimeras experimentally between the common nightshade (*Solanum nigrum*) and the tomato (*Solanum lycopersicum*). Using the cleft method of union, Winkler grafted shoots of the seedling tomato upon the stem of the nightshade. As soon as the union had taken place, the cion was cut near its base in such a way that the cut surface consisted partly of nightshade and partly of tomato tissue. Of the adventitious shoots arising, only those which sprang from along the line of the union of the two specifically distinct tissues were allowed to grow. Among a large number of adventitious shoots, about 3,000 is all, several were found which gave the desired result: .i e. they were apparently hybrid in character. Some resembled more closely the nightshade, some the tomato, while still others were intermediate in foliage, flowers, and fruit. A number of these were planted as cuttings and were grown to flower and fruition. A few set seeds while others developed fruit but no seeds. The seeds of one of them which Winkler named *Solanum tubingense* and which more closely resembled the nightshade, developed into true nightshades while those of another, *Solanum proteus* more closely resembling the tomato gave pure tomato plants. Although Winkler had produced experimentally plants that were hybrid in appearance, inasmuch as the two plants were wholly blended, yet it was clear that they were not real hybrids. The real explanation was still to be found. This was accomplished by Professor Erwin Bower of Berlin who discovered the key to the situation in his studies of the tissues of a variegated geranium. Plants which bear green leaves with white borders are well known. Such leaves are due to the fact that the green central part of the leaf tissue is covered by a layer of colorless tissue two or more cells in thickness, the thin edges of the leaves as a consequence being made up of colorless cells exclusively. Thus the colorless tissue covers the leaf as a glove covers the hand. Now it is supposed that in the growing point from which such leaves spring, a layer of colorless cells covers the green tissue beneath and a leaf originating from such growing point will consist of green cells within and colorless cells without. Likewise in the formation of a terminal bud at the juncture of the two parent tissues of the graft, the tissues of one parent, whether stock or cion, by growing a little faster, may soon cover that of the other parent and the result will be a shoot composed internally of the cells of one parent with a covering made up of cells of the other parent. This results in a periclinal chimera. If, on the other hand, one half a sector of the terminal bud be formed wholly of cells of one parent, the parts of the resultant shoot resembling the respective parents can be separated logitudinally and the result is a sectorial chimera.

Winkler's apparent hybrids, were therefore, periclinal hybrids. For example, his *Solanum tubingense* was a periclinal chimera in which the inside of the plant consisted of nightshade overlaid with one layer of tomato tissue, since the seeds produced gave pure nightshades. It will be remembered that the germ cells of spore-bearing tissues are derived from the subepidermal cells. On the other hand, *Solanum proteus* resembling more closely the tomato, and whose seeds produced pure tomato plants, is a periclinal chimera in which the interior is tomato with a covering of nightshade two cells in thickness.

From the foregoing, it is clear that these plants are not hybrids inasmuch as their seeds do not give plants of a hybrid character; they are truly chimeras.—*From an article by D. M. Mottier in School Science and Mathematics.*

BEGINNINGS OF AMERICAN BOTANY

WHAT has been the history of our botanical development? It began with the explorers, usually foreigners, who collected plants and sent them to Europe for identification and description. Then came our native collectors, who finally began to describe the plants they collected. These early workers were interested chiefly in flowering plants but occasionally there was an individual who worked with the fungi or other groups. Local natural history societies, in time, offered congenial atmosphere for the study of the local floras. Eventually governmental aid was given to exploring expeditions. Usually those engaged in botanical work were men who gained their livelihood from some other profession,—doctors, ministers and even lawyers.

There were a few institutions, however, that quite early had professors who gave limited botanical instruction and carried on investigations. Some idea of this early botanical work is given by the following notes from five of our oldest educational institutions, furnished the writer by their present botanical heads.

At Harvard, our oldest educational institution, William Dandridge Peck was appointed Massachusetts Professor of Natural History in 1805 and was the founder of the present Gray Botanical Garden. He was both a zoologist and a botanist and gave lectures in the university. Peck was succeeded in 1825 by Thomas Nuttall who was director of the botanical garden and lecturer in natural history. Nuttall lived at the Garden but evidently did not greatly relish his work as he resigned in 1834. In 1842, the Fisher Professorship of Natural History was founded and Asa Gray was appointed. This professorship has been since its foundation a botanical position.

At Yale, botany was apparently first taught to a greater or less extent by Dr. Eli Ives who held a position in materia medica and botany from 1813 to 1829. He established a small botanical garden which has since gone out of existence. After Ives' time, botanical instruction was lacking until Daniel C. Eaton was appointed professor of botany in 1864, a position he occupied until his death in 1895.

At Princeton, the first instruction in botany was probably given in the closing years of the eighteenth century by John MacLean who was professor of chemistry and natural history. From 1824 to 1829, Luther Halsey was professor of natural philosophy, chemistry, and natural history and from 1830 to 1854 a similar position was held by John Torrey. In 1874 George Macloskie was appointed professor of natural history and still occupies the chair of biology as professor emeritus.

So far as known by the actual dates given me, Columbia was the first institution in which botany was taught, since Daniel Treadwell was professor of natural history at King's College from 1757 to 1760. The first professor of botany was Richard Sharpe Kissam, 1792, who was succeeded by Samuel L. Mitchill 1793 to 1795. After that, botany was apparently included under natural history until the time of Dr. Torrey who was professor of chemistry and botany and apparently the real founder of the science at that institution.

According to both Farlow and Harshberger, the University of Pennsylvania can claim the first real botanical professorship in botany in this country as Dr. Adam Kuhn was made professor of botany and materia medica in 1768. Later William Bartram was appointed to the same chair but did not accept.—*From an address by Dr. G. P. Clinton, published in Science.*

Gladiolus Corms.—Even the gardener is often unaware of what is taking place in the soil about his plants. That many interesting things are happening there may be assumed from the behavior of the gladiolus corms. A majority of those who plant gladiolus "bulbs" in spring have the impression that the stalk and ultimately a spike of flowers will rise up out of the underground part just as the tulip flower grows from a tulip bulb. But the gladiolus has a very different method of growing. The flower spike does not come from the corm planted. Instead, when the corm begins to grow, it forms one or more corms upon the old corm and not until after these are well developed and the old corm practically drained of its substance, does the flowering spike push up. All corms, of course, are regarded as short, upright underground stems, and the new corms are in the nature of branches. Whether the flowers spring from the old or new corm depends entirely on whether the food is transferred before or after flowering. While the new corms are carrying on their work, other smaller bodies called cormels and intended for reproduction are being formed at the base of the new corms. These cormels are often borne on short stalks somewhat like tubers are borne in other plants and serve to indicate the general relationship that exists between all underground stems.

NOTE *and* COMMENT

Common Names of Purple Avens.—People in the vicinity of Meriden, New Hempshire, call the purple avens (*Geum rivale*) the chocolate plant and this seems to be the only name it is known by here. One person said he had often cooked the root and used is for a drink and that it tasted like chocolate. The root is chocolate colored, four to six inches long and covered with fine fibrous roots. Who ever heard of its being used in this way or given this name?—*W. M. Buswell, Charlestown, N. H.* [In other parts of the United States this plant is sometimes known as indian chocolate, Evans' root, throatwort, throatroot and cure-all. It is reputed to be aromatis, tonic, and a powerful astringent. Evidently Evans was an early practitioner who included this root in his pharmacopeia. The fact that the root is an astringent no doubt accounts for the name of throatwort. It would very likely be used in the ancient days when quinsy frequently threatened to stop the breath of the worthy inhabitants of New England and an astringent was needed. Darlington says that a decoction of the root was taken with cream and sugar, like coffee. but it is probable that it was not used thus as a beverage but rather for its tonic or astringent effects in certain ailments, such as dyspepsia, for which it was regarded as a specific.—Ed.]

Remedies for Ivy Poisoning.—It begins to look as if there were as many cures for ivy poisoning as there are ways of curing a cold. We can now add to the remedies already published in this magazine, tincture of grindelia and also the inner bark of the common elder covered with buttermilk. Alum dissolved in alcohol is recommended by another subscriber. If any reader of this magazine suffers in future from ivy poisoning, it would seem to be his own fault when he has so many infallible remedies from which to select.

FRUITING OF THE LADY-SLIPPER.—A subscriber asks "Do *Cypripediums* bear seeds every year? I fail to find any signs of such development in this town this year, but I find the last year's seed pods, especially those of *Cypripedium acaule* standing in the cluster of this year's leaves. There is nothing left to show that they bore any blossoms this year except the stem and the upper bract, which remains." It often happens that when a plant has borne seed one season it rests the following year and fails to produce flowers, but when flowers are produced as in the present case, another reason for the lack of seeds must be sought. Owing to the highly specialized methods of pollination in vogue among the orchids, many flowers annually fail to set seeds. Only certain insects can effect pollination in these plants and when these insects are absent no seeds can form. Anything, therefore, that affects the insect crop may influence the orchid crop as well. Probably the rarity of many orchids is as much due to a lack of proper pollinating insects as it is to other adverse conditions. Nature is apparently aware of the orchid's handicap in the matter of pollination and endeavors to make up for it by allowing the flowers to remain open for longer periods than do those of most other plants.

VIOLA PEDATA IN OHIO.—This species is known to occur in two of the extreme southern counties of Ohio, Lawrence and Scioto. At Ironton in Lawrence county the plant is very abundant on a steep grassy hillside facing the southwest. The common form present is the one with strongly contrasted petals. The upper petals are dark violet as described in the manuals and the lower are rather pale lilac-purple. It is a large, beautiful flower. The other form usually recognized, with all the petals of the same lilac-purple is quite common, intermingled with the more showy form. There are on this same hillside various intermediate color forms between the two.—*John H. Schaffner, Columbus, Ohio.* [The two-colored form of the bird-foot violet was originally regarded as a strictly eastern form of the plant, but a long time ago, Thomas Meehan recorded it in Pennsylvania, Indiana and Illinois. Its discovery in Ohio completes the chain as far west as Iowa. In all probability this bicolored form may be expected wherever the species is found. The two forms of the plant doubtless represent two elementary species but if so there are several questions regarding them that need to be settled. Does the two-colored form breed true or does it produce both forms from seed? Can pure strains of both forms be bred? If the two forms thus produced are then crossed, will the characters separate out in the usual Mendelian ratio? Those who have access to both forms of the plant might find the solution of these problems an interesting piece of work.—Ed.]

Queer Cactus Fruits.—The various species of cactus are usually cited as examples of the extreme in plant form, but recent investigation has shown that unusual forms are not the only instances of peculiarities possessed by these plants. Their methods of bearing fruits in some species seems without a parallel. Most plants develop and ripen their fruits soon after the flowers have fallen, but some species of cactus do not begin to form their fruits for a year or more after flowering. According to D. S. Johnson, other species are still more tardy in dropping their fruits. In some cases the fruits are retained for as many as fifteen years and during this time the original fruit by a sort of proliferation may become a multitude. In *Opuntia fulgida,* for instance, the primary flower has hardly fallen before other flower-buds originate on the young fruit and these in turn give rise to other flower buds until by the middle of July, the plant may have four different sets of fruits which have sprung from the original flower. Even then the fruits do not fall off. They may continue to grow for several seasons and are likely at any time to bud out new flowers and ripen new fruits. In this way a cluster of a hundred or more fruits belonging to from ten to fifteen generations may be formed. A curious fact in this connection is that if one of these fruits be placed in moist soil it will develop roots and shoots and form a new plant, but left on the parent plant, it produces only new flower buds. While most plants drop their fruits at the end of the growing season, there are some, notably certain pines and eucalyptuses, which may retain them for a term of years, but none of these continue growth and originate new fruits as the cactus does.

FLOWER COLOR.—Many students have doubtless observed that one of the commonest flower colors is a sort of purplish pink that often just misses becoming a distinct rose or a decided red. As a matter of fact, good reds and pinks are comparatively rare in any flora and the reason for this is coming to be well understood. The normal color of the pigment which produces both red and blue flowers is this same purplish pink. When the sap of the plant is alkaline this purplish pink turns to blue and when it is acid the flowers become pink or red. When this is realized, several other peculiarities of flower color become intelligible. For instance, there are many blue flowers, such as the lungwort (*Mertensia Virginica*) which are pink in the bud. As the flowers open and oxidation processes reduce the acidity of the cell sap, the pink must of necessity become blue. This also explains why so many blue flowers have pink counterparts or the reverse. Let a strain with a tendency to acid cell sap appear in a race of blue flowers and its blossoms are likely to become pink or red. The rose-colored variety of the common New England aster may be explained in this way. There are also many white flowers that are pink either at the beginning or end of their period of bloom. Apple blossoms, and the flowers of the white trillium and cotton will come to mind in this connection. In these flowers it apparently needs but a slight increase or decrease in acidity to develop or destroy the color. We do not, however, have to depend upon instances like these to substantiate our theories regarding changes in color. Almost any pink or blue plant juice may be used to demonstrate the facts. Anyone who will boil out the color from a purple cabbage may turn the juice blue by the addition of a few drops of ammonia or a little baking soda and restore the original pink color by adding a few drops of vinegar or other acid. Beet juice and most of the fruit juices act in the same way and it is therefore not surprising to find that the familiar litmus paper so commonly used in testing for acids and alkalies is made by dipping strips of paper in the juice of certain lichens. Many pink flowers may be turned blue by exposing them to the fumes of ammonia for a few minutes and blue flowers become pink when exposed to acids. In making these experiments, however, one is often astonished to find the color change produced is neither pink nor blue but *green,* a fact which opens up other avenues of speculation, but in all of which we discover how cleverly nature produces a variety of effects with almost identical materials.

Wood for Golf Clubs.—Not being enthusiastic golfers, we have never paid much attention to the material of which golf clubs are made, but possibly some of our readers have attained that enviable position where golf may be played without neglecting other really important matters, and these may be interested in knowing that the wood of the crab tree was once regarded as the only wood worth considering for the heads of golf clubs. When the supply of crab tree wood ran short, beech was used for a time but was ultimately given up for persimmon. It is said that this latter wood is now used almost exclusively for this purpose. Sir Herbert Maxwell, writing in *Kew Bulletin* now suggests a substitute for persimmon in the wood of *Cotoneaster frigida* and other species of *Cotoneaster*. These plants are members of the rose family and therefore closely related to the crab tree from which the original clubs were made. In the Old World, walking sticks, alpenstocks, agricultural implements, staves, and bows are made from this wood. The trees which produce it are abundant in various parts of Asia, especially in the Himalayan region.

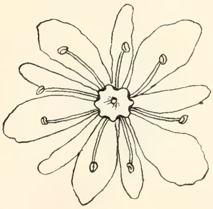
OUR LARGEST TREES.—A recent effort by the American Genetic Association to locate and identify the largest American trees resulted in the discovery of a sycamore or buttonwood (*Platanus occidentalis*) which is more than 42 feet in circumference and 150 feet high. Other large trees reported were a valley oak (*Quercus lobata*) 37 feet in circumference, a chestnut (*Castanea dentata*) 35 feet in circumference, a tulip tree (*Liriodendron tulipifera*) 34 feet, a sassafras (*Sassafras variifolium*) nearly 16 feet, a white birch 12 feet, a pecan (*Carya Illinoensis*) 19 feet and a catalpa (*Catalpa speciosa*) 16 feet in circumference. The largest elm reported was the "great elm" at Wethersfield, Connecticut, which is about 28 feet in circumference.

GINSENG BLIGHT.—It is true that the dried roots of the ginseng (*Panax quinquefolia*) often sell for $7.00 a pound, but it is also true that even at this price, ginseng is not always a profitable cultivated crop. The roots are rather small and require several years to reach maturity and during this time are exposed to a variety of dangers. One of these is the ginseng blight (*Alternaria panax*) which often blights both the foliage of the plants and the hopes of the grower. The disease has been known for a long time as affecting the above ground portions of the plant, but only recently it has been found infesting the roots as well. When the roots are attacked they become brown and shrunken but do not become soft as they do when attacked by other kinds of rot. As in the case of other fungous pests, spraying with Bordeaux mixture has been found to be the best preventive, but the removal and destruction of the tops in autumn and even burning over the bed, late in the year, are additional helps of value.

False Toad-flax Harmful.—The species of false toad-flax (*Comandra umbellata* and *C. pallida*) have long been known as hemi-parasites which draw part of their food from the underground parts of other plants to which they attach themselves by means of hemispherical disks or holdfasts formed by the roots. They are probably most frequently parasitic on various species of blue-berry (*Vaccinium*) but they are known to attack some fifty other species including such diverse forms as herbs, shrubs and trees. As parasites, however, they cause little injury. Their harmfulness comes from their harboring on their leaves one stage of a very destructive blister rust (*Peridermium pyriforme*) which in another stage attacks several commercially valuable species of pine. In the West the species most subject to attack are *Pinus contorta*, *P. ponderosa* and *P. divaricata*, while in the East, *Pinus pungens* and *P. rigida* are victims. It is said that the rust is entirely dependent upon the toad-flax for the completion of its life cycle, and if this be so, the destruction of this plant in the vicinity of pine forests and nurseries of young plants is to be desired.

Fruits Eaten by Thrushes.—A Government report on the food habits of our thrushes throws an interesting light on one phase of seed distribution. Plants which produce fleshy fruits such as berries are supposed to be disseminated by birds, but wonder is often expressed at the unpalatable or even poisonous nature of many of these since it should cause them to be avoided instead of sought by birds. It is natural to assume that birds are fond only of the fruits that are palatable to us, but investigation shows that we cannot set up our own standards of taste as criteria for other animals. Probably all varieties of fleshy fruits are eaten at some time or other, though some may be neglected while better ones are to be had. Among the thrushes, the hermit thrush seems to have the greatest range of taste in the matter of berries. He is known to eat more than sixty kinds. Practically all our edible fruits are in the list besides such kinds as those of false Solomon's seal (*Smilacina*), green briar (*Smilax*), wax myrtle (*Myrica*), mistletoe (*Phoradendron*), partridge berry (*Mitchella*), poke berry (*Phytolacca*), spikenard (*Aralia*), chokeberry (*Aronia*), sumac and poison ivy (*Rhus*), pepper (*Schinus*), holly and winterberry (*Ilex*), bitter-sweet (*Celastrus*), woodbine (*Ampelopsis*), black gum (*Nyssa*) and elder (*Sambucus*).

Profits in Drug Plants.—The get-rich-quick idea has occasionally found lodging in the mind of even the plant student. The great tulip craze, in Holland, is a matter of history, and there was once a similar flurry on this side of the water regarding the growing of the mulberry. At the present time we are just emerging from the ginseng craze which influenced many of our fellow-citizens to invest their hard earned money in this plant in the hope of suddenly becoming millionaires by selling a single crop of it to the Chinese. We have heard of no very great fortunes amassed in this way, however, and those who would be rich had better stick to steel or Stanard Oil. There was some money made in ginseng, but most of it was made by dealers who sold seeds of the plant to others for 2 cents each, or who sold the plants, not to the Chinese, but to Americans who wanted to start a garden. This way of making money selling ginseng reminds us of that famous Dutch city in which all the inhabitants got rich taking in one another's washing. As a matter of fact, the business of growing drug plants does not at present offer much attraction to those who hope for success without working hard for it. A recent bulletin of the United States Department of Agriculture entitled "Drug Plants Under Cultivation," disposes of the idea that easy money is to be made in growing drugs, in the following language: "Very few, if any, drug plants are used in quantities sufficient to make them a promising crop for general cultivation. Many of the commoner ones which can be grown and prepared for market with little difficulty, bring but a few cents a pound and their cultivation offers little prospect of profit. A number of the high priced drug plants must be given care for two or more years before a crop can be harvested, and since expensive equipment is usually required for their successful culture, the production of such crops offers little encouragement to inexperienced growers who are looking for quick returns and large profits from a small investment. The production of drugs of high quality requires skillful management, experience in special methods of plant culture, acquaintance with trade requirements, and a knowledge of the influence of time of collection and manner of preparation on the constituents of the drug which determine its value. Small quantities of drugs produced without regard to these conditions are apt to be poor in quality, and so unattractive to dealers and manufacturers that the products will not be salable at a price sufficient to make their production profitable. In general the conditions in this country seem far more favorable to the growing of drug plants as a special industry for well equipped cultivators than as a side crop for general farmers or those whose chief interest lies in the production of other crops. Although a number of plants which yield products used as crude drugs are common farm weeds, they usually occur in such scattered situations and in such small quantities that their collection would scarcely prove profitable to the farmer. Even when relatively abundant it is a matter for careful consideration whether the time and labor necessary for their collection might not be otherwise employed to better advantage. Moreover, it is not always easy to distinguish medicinal plants from others of similar appearance and collectors not infrequently find that they have spent their time in gathering plants practically worthless as crude drugs. In proportion to the labor required in the collection, relatively low prices are paid for most crude drugs obtained from wild plants, and the farmer who turns to drug collecting as a source of additional revenue will probably meet with disappointment." Getting rich in the drug plant business may do all right in a popular novel, but it will not work in everyday life.



EDITORIAL

This number of the magazine is the first one issued since a considerable number of new names have been added to our lists as a result of a campaign for subscribers, and it seems fitting that we take this opportunity to make a few statements by way of introduction. We may begin, then, by saying that this is the only botanical magazine in North America that is not subsidized by some botanical club or institution. Its motto has ever been a paraphrase of that somewhat inelegant though expressive command "Root hog or die." So far it has shown a commendable disposition to root. The editor, like the editors of all other botanical publications, whatsoever, earns his salary in other fields and runs the magazine for his own amusement, though it is customary to throw some bluff about it and to intimate that his hours of profitless labor are spent "for the good of the cause" or "because of his devotion to botanical science." In no sense, however, does he consider this his own private publication. He expects his subscribers, readers, and friends (the terms are not always synonymous) to supply sufficient matter to fill it and when they neglect this golden opportunity, as they so frequently do, he has to do it himself. Often he waits so long to see what his contributors will do, that he gets hopelessly behind, as in the present instance. Such delays , though mildly irritating, do not much disturb the old subscribers who know from past experience that every number will appear sooner or later and reason that the delay is probably more their own fault than it is the editor's. The magazine is always decidedly in need of the right kind of articles. If we were willing to run technical matter, we would never have any difficulty in filling the magazine and issuing it on time, but we know what would happen to our subscription list if we used that kind of material. So far as we know, this is the only magazine in the world devoted to popular ecology, and this, while by far the most interesting phase of botany, is still so new as a science that writers and investigators are few. Our readers are therefore invited to send us any notes or articles they may happen to produce along the lines in which the magazine is interested. Our readers are for the most part philosophical botanists interested more in plants as living things than in making collections of dried plants or in learning the names of additional species. We are personally acquainted with a large number of these readers and do not know one who is not above the average of the intelligence and culture in his community. It is in this eminent company that our new readers find themselves, and we trust they will join them in making this their magazine truly representative of the phase of botany to which it is devoted.

* * *

At this season, when a large number of renewals are coming in, we again direct attention to our "Permanent" list. A "permanent" subscriber does not mean one who expects to be a subscriber forever, but it does mean one who is enough interested in the magazine at present to wish it to continue coming to him and backs up his wish with an order to that effect. Though "permanent" subscribers pay but 75 cents a year for the magazine, and pay during the year when it is most convenient, the magazine is advanced by having a body of sustaining subscribers who do not have to be annually induced to renew. A very large number of our subscribers belong to this class. Anybody may become a permanent subscriber by paying for two years in advance at the special rate of $1.50 and directing the magazine to be sent thereafter until ordered stopped.

There are no strings of any kind to this offer. No term of years through which the subscription is to run is named. It simply means that we are willing to accept subscriptions at less than regular rates from those who are interested in sustaining the magazine by more extended subscriptions than ordinary.

* * *

About the time the sun pauses over the tropic of Capricorn preparatory to beginning a new journey northward, the seedsmen are putting the finishing touches upon the spring catalogues. In a few more weeks the mails will be full of them. In this vast annual output, one may find many varying degrees of excellence. Some are clearly intended to serve only the purpose of the moment and soon find their way into the waste basket, but others are so well arranged and so carefully printed that we hesitate to discard them and usually have a stock of them on our shelves for reference. Such a catalog is the Handbook of Trees and Hardy Plants issued by Thomas Meehan & Sons, Germantown, Pa. Besides giving sizes as well as prices, it includes a large number of shrubs and other plants that other dealers do not list. In a similar way the catalogue of Thorburn, Barclay Street, New York, excells in the offering of seeds of flowering plants. The honor of issuing the largest catalogue lies between Sutton of England and Dreer of Philadelphia. We give our preference to Dreer, especially as his catalogue lists many greenhouse plants. Farquahar's Garden Annual from Boston is of special interest since it included many of the new plants discovered by Wilson in various hitherto unexplored parts of China. Probably the most artistic catalogues issued are sent out by the Biltmore Nursery, Biltmore, N. C. There are four catalogues issued filled with fine illustrations of plants. It is reported that this nursery, however, is going out of business. The most extensive handbook of spring flowering bulbs is probably that of Chester Jay Hunt, Montclair, N. J. For irises, peonies and phloxes the list of W. H. Farr, Wyomissing, Pa., is probably best. If this were an advertisement for the seed and plant houses, we would include many others in our list, but it is not. We simply have mentioned some of the catalogues which we have found of special interest, with the idea that others may like to know of them.

* * *

A few years ago, a good many of our readers were doubtless solicited to join the "Luther Burbank Society" and then by the payment of a certain sum to receive a set of books detailing the wonderful creations produced by the "Wizard of Horticulture." The pathway of the society may have been strewn with roses, but evidently somebody neglected to remove all the thorns for the *Rural New Yorker* recently printed the following: "'What is their little game, anyway?' That is what people asked at the time the Luther Burbank Society was sending out its rose-tinted guff and asking people to join the immortals by becoming a 'life member.' We did not know then what the game was, but it is being developed now. All capital stock in this Burbank Society is being assessed one dollar per share. There are liabilities of $73,023. Among the 'assets' is the item of $287,500 as 'value of the exclusive right to use the name of Luther Burbank and to distribute his horticultural productions.' The 'little game' seems to have been the same as that of the shell game, a run for your dollar. What a farce the whole thing was. How they did play on the vanity of hundreds of men and women who ought to have known better." The editor of the *American Botanist* was asked to read the proof of the several volumes of the Society as they passed through the press, and actually received the first installment of several pages. It was, however, so inaccurate in respect to facts that several pages of corrections were sent back to the Society and that ended the proof-reading. Thinking that the real name of the Society should be spelled Burbunk we wrote direct to Luther Burbank and received a note from him in which he denied any connection with the Society. If that set of books is ever really issued, it ought to afford most entertaining reading to the discriminating botanist.

* * *

You never can nip these nature-fakers in the bud. They always burst into full bloom in some unlooked for quarter, such as the local papers, and become disseminated through the lay press before the scientists start in to eradicate them. Take this specimen from the columns of the *Big Four Successful Poultry Journal,* quoted by *Modern Gladiolus Grower.* "You all know the gladiolus. While we keep some strains of bulbs in their purity, the blending of colors by propagation is so fascinating that we blend a large number of different colors every year. This is done by setting two bulbs of different colors so that they touch each other in the bed. The young bulbs that form that season will throw blooms of different colors from the parent bulb and while we cannot tell just what colors to expect, we are sure of some new color creations every season." Such a proceeding must indeed be "fascinating" as the author claims. Even to read about it is fascinating, but for our part we are more fascinated by the colossal ignorance of botanical principles displayed by the writer. It is absolutely impossible for even a "wizard" in horticulture, such as they keep on the Pacific Coast, to perform such a feat. A poultry journal, we incline to think, should stick to its chosen field. Readers who would believe such stuff about crossing the gladiolus would as readily swallow a story to the effect that woodpeckers lay wooden eggs and the latter tale would be much more appropriate for a journal of this kind. We recently noted in another publication the assertion that new varieties of sweet peas were made by taking the seeds of two varieties and sticking half of two different seeds together. Anybody gullible enough to believe this should try it.

* * *

Here is another gem quoted by *Horticulture*. "That there are meat-eating plants is generally known, but that there are also plants that cough—not figuratively, but in the true literal sense of the word—will be surprising to most readers. Indeed, to the researches of a French botanist we owe the description of a plant growing in certain tropical regions which obviously coughs like a human being. It is very sensitive and shows a strange dislike to any kind of dust. No sooner do a few grains of dust settle on its leaves and thereby irritate the air chambers of the sheath scale which represents the organs of breathing, than these organs fill with a kind of gas, swell up, and then explosively reject the gas whereby the dust is expulsed. This explosion produces a sound which has a striking resemblance to the cough of a child who has caught cold." The writer says we would be surprised to hear of this plant and we gracefully own up. We are. Any time the plants in our vicinity begin to cough, "not figuratively but in the true literal sense of the word", we are going straight off to consult a doctor and we advise our readers to do likewise under similar circumstances. We insist that it is not natural for a plant to cough, principally because it lacks coughing facilities, having neither lungs, trachea, throat nor diaphragm. Why did not our nature-faker turn that cough into a sneeze and explain that the plant sneezed because the dust tickled its nose. It would have been just as truthful. The French botanist who originated this remarkable story ought to be rounded up and sent to the front at once. He ought to be able to annihilate whole battalions and sink all the submarines—on paper.

BOOKS AND WRITERS

The publishers of Underwood's "Our Native Ferns" inform us that this book is no longer in print. It is the only complete descriptive manual of North American ferns. Issued originally in 1880 it has gone through six editions and is regarded as a classic by all fern students. The rapid advances in the study of ferns has rendered even the latest edition out of date, but it is to be hoped that a revised edition may be forthcoming.

Fifteen years ago, a small magazine with the large title of *Ohio State University Naturalist* began publication at Columbus, Ohio. Some time later the name was changed to the *Ohio Naturalist* and this title it has borne up to the present. Hereafter, however, it is to be known as the *Ohio Journal of Science,* the official organ of the Ohio State University Scientific Society and of the Ohio Academy of Science. With the new title goes an increase in size and a thoroughly grown-up appearance. The former editor, Professor John H. Schaffner, of the Botanical Department of the University, will continue to direct the new magazine, an indication that it will suffer no diminution in interest and value.

A new book by Edward A. White in Macmillan's "Rural Text-book Series" is entitled "The Principles of Floriculture." This is not, as one might infer, a guide for the amateur gardener, but is directed more particularly to those who make flower-growing a business. The bulk of the volume is given up to a description of various forms of glass houses and the plants usually grown in them, but the opening chapters deal with the development of the cut flower industry and market conditions, and later chapters discuss the growing of cut flower crops, foliage plants, plants for forcing and the like. The book appears to be a careful summary of modern methods without the expression of any very decided opinions by the author. The facts are given and the reader allowed to select and decide for himself. All points upon which the grower is likely to desire information, however, seem adequately covered and the commercial man will no doubt find much valuable material in it. We note that the author uses order in place of family in his classification, though this usage has long been abandoned by botanists. The book contains upward of 450 pages and costs $1.75.

The wide-spread interest in apple growing has called forth a book on the subject from the pen of A. E. Wilkinson. In "The Apple," published by Ginn & Co., he has brought together nearly 500 pages on all phases of growing, storing and marketing this king of northern table fruits. The wide territory over which the apple is grown seems to have made it impossible to give directions that would apply equally well to cultivation in New York and New England as well as in the irrigated lands of the Northwest, but the methods in vogue in the various regions are fully described. Though much of the book is of necessity a compilation, the result is a very useful volume on orchard management. In view of the great number of school teachers and others of limited means who have recently invested in orchards in the Northwest, it is a surprise to learn that New York State still leads in apple production. In 1912 this State produced nearly 7,000,000 barrels of apples, a crop greater by more than 2,000,000 barrels than that produced by the entire Northwest, including California, Colorado, and Utah. "The Apple" is the latest volume in the Country Life Education Series of Ginn & Co. and costs $2.50.

Another of the Nature Notebook Series edited by Mrs. Anna Botsford Comstock has appeared. This time it is a book for recording notes on plants. In this the first dozen pages are devoted to a description of plant parts and then follow sets of questions on 34 points about the plant upon which notes are to be made. It is safe to say that anybody who carefully answers these questions about a given plant is certain to know it pretty thoroughly. The notebook is an agreeable change from that type of book in which the ends sought were the common and scientific names of the plants. It ought to do a great deal toward developing a race of philosophical botanists. The Notebooks are issued by the Comstock Publishing Co., Ithaca, N. Y., at 30 cents each.

In "My Growing Garden", J. Horace McFarland has detailed the rejuvenation of an old garden which, after many years of neglect, came under his care. From late winter into spring, through the growing season and on until the plants have entered into another period of rest, the reader is carried by a bright and interesting narrative whose only defect is an inclination to slang of a not especially expressive character. The chief interest in the book lies in the fact that it is an account of a real garden and tells about plants, plant methods, and results that are sure to interest the great race of amateur gardeners, though they may not be especially helped in their own gardening operations thereby. The book is well made and contains several excellent illustrations. It is published by the Macmillan Company at $2.00.

The editor of this magazine has written a little "Botanical Textbooklet" designed to give the non-botanical a short cut to knowledge by enabling him to recognize the members of the principal plant families at a glance. Often a single character is enough to identify such a family. In addition to a description of such characters, there is more or less information concerning the number and distribution of the species in each group, the color of the flowers, the edible, medicinal and other qualities they possess, with the names of the more conspicuous genera. The "Textbooklet" is sent free to all new subscribers who ask for it at the time of subscribing, and to those who renew for two years in advance. To others the price is 25 cents.

THE AMERICAN BOTANIST

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EDITED BY WILLARD N. CLUTE

Volume XXII

JOLIET, ILL.
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THE AMERICAN BOTANIST

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25 Cents a Copy; $1.00 a Year

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A Quarterly Journal of Economic & Ecological Botany

WILLARD N. CLUTE, EDITOR

SUBSCRIPTIONS.—The subscription price of this magazine is $1.00 a year or $1.50 for two years, payable strictly in advance. Personal checks on small or distant banks must contain ten cents for collection fees. The magazine is issued on the 20th of February, May, August and November.

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In 1913, at the completion of its twentieth volume, **The Fern Bulletin** was consolidated with this magazine. The back volumes average more than 100 pages each, and since they cover the entire formative period of American Fern study they are invaluable for reference. The majority of new forms discovered in recent years have been described in its pages. First six volumes out of print. A set of vols. 7 to 20 will be sent for $7.00. An extended description of the contents of the volumes may be had for the asking.

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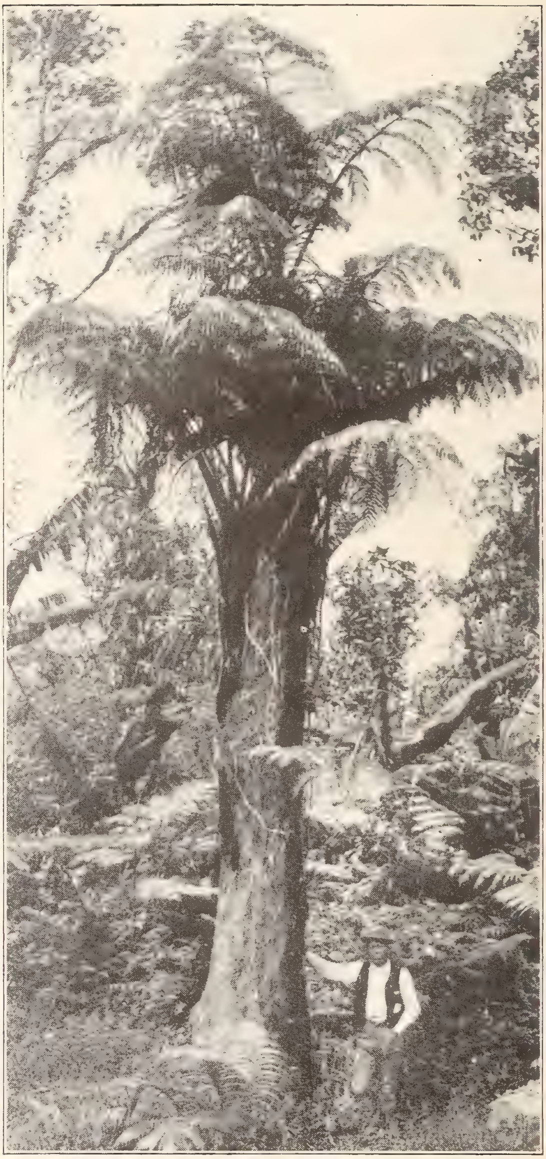


A large tree fern—*Cibotium Menziesii.*

THE AMERICAN BOTANIST

VOL. XXII JOLIET, ILL., FEBRUARY, 1916 No. 1

Every clod feels a stir of might
An instinct within it that reaches and towers
And groping blindly above it for light
Climbs to a soul in the grass and the flowers.
—Lowell.

Smithsonian Institution
JUN 13 1916
National Museum.

THE TREE FERNS OF HAWAII

By Vaughan MacCaughey.

THE tree ferns are undoubtedly a declining race. Long ago the humid epoch of their dominance waxed and waned. The coal beds reveal the deathless delicacy of those ancient fronds. The slate strata are sprinkled with the leaf-prints of the primitive plant-world. Few sights stir the botanic imagination as does a cabinet of fern fossils. Each fragment visualizes an earth-epoch antedating today by immeasurable vastnesses of time. The cinematograph-reel of paleobotany whirls back, and flashes strange pictures of illimitable jungle-forests—skirting the world mountains, girdling the Poles, covering great areas of China, Australia, and many other lands. The coal and oil fields of today are the herbaria, the cemetaries, of those spacious Carboniferous swamps.

Recent studies in paleobotany have necessitated extensive revisions of current ideas concerning the Carboniferous fern-flora. The prevalent conception of the arborescent pteridophytes as constituting the major part of the swamp-forest vegetation, has been demonstrated to be erroneous. Many of the supposed fern fossils have proven to be the leaves and stems of primitive gymnosperms. The apparent decadence of the pteridophytes is thus not so great as was once commonly believed. The tree ferns probably never comprised a dominant element of the Carboniferous forests.

The arborescent ferns are today widely distributed throughout the humid tropics. They give a distinctive appearance to many of the equatorial rain-forests. In favored regions, like Hawaii, they form pure stands of considerable magnitude. Australia, New Zealand, Malaya, Ceylon, Africa, Central and South America, all possess fern forests. The important genera are: *Cyathea, Alsophila, Hemitelia, Dicksonia, Thyrsopteris, Cibotium,* and *Balantium.*

Although associated in the popular mind with a hot-house atmosphere and a gorgeous tropic background, in reality the tree ferns manifest a considerable range of thermal adaptation. They literally extend from the steaming jungle, "where the blazoned, bird-winged butter-flies flap through," to the icy rim of the Antarctic. A number of the Tasmanian and New Zealand ferns are annually subjected to very low temperatures. It would appear that the critical factor governing the geographic distribution of the tree ferns is not primarily a high temperature, but high atmospheric humidity fairly continuous throughout the year. The perennial crown of gigantic fronds is vitally dependent upon a moist atmosphere. It cannot long withstand drought, nor thrive in a xerophytic habitat.

Small clumps and groves of tree ferns are abundant on the mountain slopes of all the larger islands of the Hawaiian archipelago, but the finest stands are limited to the island of Hawaii. This is the largest and youngest island of the group, in fact its area (four thousand square miles) is greater than the combined area of the others. Hawaii's large size, its great volcanic domes rising to nearly fourteen thousand feet, its extensive lava flows, and its long windward coast line, all combine to give this island a remarkable series of ecologic zones. Within the range of few miles one may run the full climatic gamut of the hymn "From Greenland's icy mountains to India's coral strand." There is conspicuous diversity in annual temperature and precipitation in the various zones and districts, from tropic to frigid, and from sunburnt desert to dripping rain-forest.

The fern forests lie along the windward and middle slopes, in the cloud-zone of fairly continuous humidity. Puna, Hilo, Ola'a, parts of Hama-kua and Ko-hala, and wet districts on Mauna Kea and Hu-ala-lai are the chief areas occupied by the tree ferns. The total stand may be very roughly stated at eighty to one hundred square miles.

Of the seven genera and three hundred species of the tree ferns (Cyatheaceae), only one genus, *Cibotium,* with three endemic species, occurs in the Hawaiian Archipelago. The fern forests of Hawaii are composed of *C. Menziesii, C. Chamissoi* and *C. glaucum;* the latter rare and of minor importance. *Cibotium* is from the Greek, "a little seed vessel," and has reference to the conspicuous indusia. Menzies was the botanist with Vancouver's historic expedition to Hawaii in 1792-94; the botanist Chamisso accompanied the Russian expedition under Kotzebue (1816).

Menzie's tree fern, called *hapu i'i'i* by the Hawaiians, is the largest native species. In favorable localities it attains regal proportions. The brown spongy trunk is frequently two or three feet in diameter, and rises without branching to a height of twenty or twenty-five feet. From its summit springs a magnificent canopy of huge, tri-pinnate fronds; this splendid fountain of greenery being ten or twelve feet high and twenty to twenty-five feet in diameter. However, with all its glory of crown and magnitude of trunk, the *hapu i'i'i* never reaches the stately proportions of the justly famous Norfolk Island tree ferns. These belong to the species *Alsophila excelsa,* and are frequently from sixty to eighty feet in height.

Chamisso's tree fern, *hapu,* is more abundant, and more widely distributed than its larger relative. It occurs on all of the high islands of the archipelago, and is plentiful in the humid lower and middle forest zones. Its trunk is usually but six or eight feet in height, and its crown never equals the magnificent dome of the *hapu i'i'i.* Under very favorable conditions the trunk may rise to fifteen feet, but this size is exceptional.

The popular notion that tree ferns are tender and easily-damaged is derived from kinds quite different from the hardy *hapu.* The tree ferns possess great vitality, and will rejuvenate themselves after repeated injuries. The Hawaiian *Cibotiums* are able to maintain themselves in many districts overrun by cattle, goats and swine. These half-wild herbivores have irreparably damaged much of the native woodland, but have not so seriously injured the tree ferns. The wild pigs are particularly obnoxious by reason of their rooting habits, and undoubtedly destroy considerable quantities of young fern trees. The pig hunters well know that fern groves are the favorite haunts of their game.

The large petiole-bases, and the terminal bud, (which is as big as a man's head), are densely covered with a thick matting of golden-brown hair. This soft, silky substance is called *pulu* by the natives. Under the microscope the individual hair is seen to consist of a series of flat, thin-walled cells, large at the base and tapering to a slender apex. In the early days *pulu* was exploited commercially as a stuffing for pillows and mattresses. Several hundred tons were annually exported to California, in addition to the large local trade.

The natives who gathered the *pulu* displayed the same lack of foresight as did the sandalwood cutters of an earlier Hawaiian era. No thought was given to the conservation of the supply. Whole groves of splendid *hapu i'i'i* were felled in order to more easily gather the golden harvest. A few machete-strokes were less laborious than climbing the tree. This recklessness ruined many of the finest groves, and cause a rapid shrinkage in the supply. The industry was further curtailed by the inherent inferiority of the *pulu* itself. The hair is brittle and weak-jointed, and in usage soon breaks into fine pieces. The mattress becomes hard and lumpy, and its elasticity cannot be restored. The rapid deterioration of *pulu* products was soon discovered by the trade. The exploitive industry dropped forever from the commercial world, to the great good fortune of Hawaii's beautiful fern forests.

Humorous stories are told of the tricks used by the *pulu*-mattress makers to stimulate trade during the decadent days of the industry. A secretly-hired emissary would be sent to a hotel or lodging house; he would pretend to desire lodging for several weeks; then, just before registering, he would inquire, "does the bed have a *pulu* mattress?" If the reply was to the contrary, as was frequently the case, he would emphatically state that he never slept on any save a *pulu* mattress; express high indignation at the shortcomings of the hostlery; deliver a fluent harangue on the virtues and excellences of *pulu;* and stormily depart. The enlightened manager, fearful of losing other *pulu*-preferring guests, would thus be inveigled into ordering some of these short-lived mattresses.

These dense bud-and petiole-coverings of silken brown hair are not confined to *Cibotium,* but occur on other genera of tree ferns. The *pulu* of a javanese *Dicksonia* is exported to Europe in considerable quantities as a surgical styptic. It is of interest to recall in this connection the fabulous mediaeval stories of the "Scythian lamb" or *Agnus Scythicus.* The tree fern that gave rise to these marvellous tales is an Asiatic Cibotium, *C. Barometz.* According to the mediaeval herbalists, this wonderful creature had wool, flesh and blood, and a root extending from the navel into the soil. "The plant was said to resemble a lamb in every respect, but grew on a stalk about a yard high, and turning about and bending to the herbage consumed all within reach, and then pined away with the failure of food until it died." In 1725 an enterprising student actually examined a "lamb" and declared it to be only the rhizome of a large fern, covered with *pulu* and bearing petioles. It had been placed in an inverted position on the museum shelf, the better to simulate the body and legs of a quadruped.

The fern trunk is somewhat expanded or spreading at butt and at crown. Its least diameter is about midway between ground and terminal bud. The spongy exterior is often covered with a dense, coarse matting of short, appressed aerial roots, which turn downwards and are more or less closely intermingled with the fibrous material of the stem. On old trunks these multitudinous roots, living and dead, form a dark coating, sometimes several inches in thickness. In Honolulu the Japanese gardeners and florists make considerable use of the fibrous trunks for the construction of fern-boxes and hanging baskets, and for orchid pots. They have depleted the local woodlands of the older *hapu.*

The upper portion of the trunk is disfigured with the old, hard, persistent petioles, that droop at various angles. The dead leaf blade is soon whipped off by wind and weather, but the woody stalks long remain. Occasionally one will find a fern trunk more or less completely cased in dead foliage. This condition is most marked with ferns growing under semi-xerophytic conditions.

The central part of the trunk is made of spongy, starchy parenchyma, traversed by fibrous vascular bundles. In ancient

Tree ferns form a dense and unbroken undercover.

Hawaii, the younger stems and trunks were used in time of famine for food. They were cut into sections a few feet in length, and thoroughly steamed in the underground oven, *imu,* or baked in hot ashes. The farinaceous interior was then removed and eaten. In the vicinity of Kilauea there are many volcanic steam cracks. These are turned to practical use for steam-cooking the *hapu* stems, which nowadays are fed to swine. The starchy core is quite nutritious, and under the unique local conditions of free fuel from Vulcan's workshop the *hapu* has proved to be a practicable and profitable hog-food.

In certain parts of Hawaii where the tree ferns are abundant and the soil soft and water-logged, the trunks are used for the construction of corduroy roads and trails. The coarse fibres cake down into a tough spongy matting, that is serviceable for several years without repair. Occassionally fences are made by stacking up like cord wood three or four foot lengths of fern trunk. The terminal buds, and numerous lateral buds, sprout vigorously, and soon the spongy wall is clad in a mantle of green fronds.

The fertile leaves are readily distinguished by the conspicuous bivalved indusia. These form a thick beaded rim along each margin of the segments. The indusium is coriaceous, and several millimeters in diameter. Both the inner and outer valve is free from the leaf segment. The spores are produced in enormous quantities, and are pale brown in color.

The finest fern forests in Hawaii are on the very wet slopes of the Kohala Mountains, but those most accessible to the traveller are in the vicinity of the Crater Kilauea. These occupy an area of many square miles, at 1000-4000 feet elevation. The *ohia lehua* (*Metrosideros polymorpha*) is the dominant hardwood tree of this district. Its slender gray trunk rises to a height of sixty or eighty feet. Under its fine-leaved, open canopy the tree ferns form a dense and unbroken undercover. Both species occur here, the *hapu* the more abundant, the *hapu i'i'i* the more conspicuous by reason of its stature and spread. *Cibotium glaucum* closely resembles the *hapu* and has the same geographic distribution, but is rare. According to Hillebrand, forms occur which are intermediate between the two species.

The *lehua* and the tree ferns give the Kilauea region its distinctive aspect, but a number of other trees and shrubs occur scatteringly through the forest. Chief among these are,—*Suttonia Lessertiana, Cheirodendron Gaudichaudii, Ilex Sandwicensis, Rubus jamaicensis, Broussaissia arguta, Stenogyne calaminthoides,* and several *Cyrtandras.* The soil is a thick, moist vegetable mold, overlaying ancient lava flows. In the forested district are many pit craters and steam cracks.

An interesting account of the interrelationship of the tree fern and the *lehua* is given by Rock: "Both the fern and the tree are often found growing together to such an extent that it is difficult to distinguish the tree trunk from the trunk of the fern. The natives have an idea that the *Hapu i'i'i* is the mother of the *Ohia lehua*. The seeds of the *Ohia lehua* often germinate in the crowns of the tree ferns, sending down their roots along the very fibrous, often water-soaked trunk. In time the fern begins to die and the *Ohia lehua* is left standing with stilt roots of often 15 feet or more in height, after which the real trunk of tree commences."

The fern forest has an inimitable charm and a distinctive beauty. In architecture and atmosphere, it is unique. There is no other forest canopy that feathers the blue sky with such noble fretwork. Its plumy frond spray is an incarnation of the humid air, the gentle breezes, and the tranquil filtered sunshine of its environment. There are no noisy wind-tossed leaves upon its velvet aisles; there are no crackling twigs to startle the wanderer in these green lit corridors. The sweet notes of the *i'iwi* bird tinkle bright as sunbeams through the fern domes; the brilliant scarlet of its plumage contrasts pleasingly with the great green feathers of its home. Her radiant fern groves will long remain among Hawaii's noblest treasures.

PLANT WASTES

By Miss Alice L. Gookin.

THE losses to the plant through transpiration, exudation, and in other ways is often of considerable importance. Transpiration means the passing off of water from plant surface in the form of water vapor. The water vapor escapes only at tiny perforations in the cutin of the leaf, called stomata, and through these perforations 95% of all the water a plant gets is lost in the vapor state. Guttation or exudation, is the loss of water in the liquid state. An observant person walking in a garden very early in the morning after a dry, warm night could hardly fail to notice drops of water at the ends of the veins of certain leaves. This moisture is caused by the slow oozing of a watery fluid from the leaf and is known as guttation water. By placing a fuchsia under a bell jar, these drops can be plainly seen exuding from the tips of the leaves. The exudation takes place through water pores scientifically known as hydathodes. These pores are larger than the stomata and fewer. They are located at the ends of the side veins in dicotyledons, such as the nasturtium, and at the tip of the leaf of monocotyledons as in corn, wheat and grass. The drops of water on grass tips on the lawn after a dry, warm night are not dew drops, but this water of guttation.

The hydathode, unlike the stoma, has no guard cells but is a pit lined with two or three rows of living cells. In one sense it is a widely open stoma beneath which is a reservoir filled with water driven in by filteration. The cavity is separated from the end of the water tubes by a few intermediary cells. The guard cells close the stomata in the dark and during the night the accumulated water escapes through the open doors of the water pores. Some plants, like the geranium, exude their moisture through tiny hairs. The fungi exude from the general surface.

Exudation water differs in another respect from the water of transpiration. Being in the liquid state, it carries with it many of the plant foods in solution and therefore has a composition similar to sap. As a general rule, the drops collect slowly, yet from the tip of a leaf of Elephant's Ear, 25 drops have been known to fall in one minute.

From the young leaves of certain Aroids, the family to which the Jack-in-the-pulpit belongs, water is sometimes ejected in a fine spray to a distance of a few inches. Guttation is especially common in shade plants that live in conditions which do not favor transpiration.

There is a certain kind of guttation which is commonly called "bleeding". This is the losing of sap due to cutting or injury by man, such as improper pruning. In some cases this bleeding is effected purposely, as in the case of the sugar maple and the century plant. In the sugar maple, bleeding is resorted to, to obtain the great commercial product, maple sugar. The sap of the maple represents the surplus of the tree's winter storage. In the warmth of early spring the roots begin to absorb large quantities of soil water. This dissolves the sugar and both rise in the vessels. By tapping at this time large quantities of sap may be extracted. This loss is not felt by the trees because just at this time they are sending out leaves which are able to manufacture their own food.

Sugar making begins with the upward flow of the crude sap in February or March and continues until the buds begin to swell. Trees twenty or thirty years old are considered the most productive, though there are instances of trees which have yielded sugar every year for a century and are still vigorous and fruitful. The tree which produces the maple sugar of commerce is called for this reason the sugar maple. It ranks among the finest of American forest trees. It frequently rises 70 feet without a branch and spreads its leaves to the sunlight 120 feet above its base. It is this tree which is tapped with a ¾ inch augur, to a depth of two to six inches. The sap flows through a spout inserted in each auger hole and drips into a tin pail suspended under the wound. It is a slow process, about seventy drops falling in a minute, but it continues ceaselessly and in three weeks it may amount to 25 gallons. The sap is evaporated in copper boilers, treated with a little lime to destroy the bitter taste, and poured into pans to harden. From 25 gallons of sap about 4½ pounds of sugar are made.

The century plant, (*Agave Mexicana*), surpasses even the sugar maple in the quantity of matter extracted by artificial bleeding. These plants are so big that you could not crowd the smallest of them into a hogshead. They have leaves from 6 to 8 inches thick, which sprout up from the ground to the height of 10 to 12 feet. Inside the leaves, there is a green cone as big around as a peck measure. When the plant is ripe this cone is cut out leaving a bowl which will hold about two gallons. Into this queer bowl the sap runs from the leaves in streams. Each plant produces from 8 to 15 quarts of juice a day and this continues for six months. At first the juice is quite sweet and clear as spring water, but it begins to ferment in a very few hours and within a day has turned into an intoxicating drink known as "pulque", the Mexican national beverage.

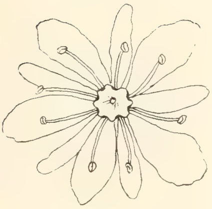
Some of the minor losses through exudation are those of volatile oils, gums, and resins. To the presence of the volatile oils is due the fragrance of many flowers and fruits, notably those of the mint and geranium. The plant acids also belong to this group. Acids are usually retained in the plant, and yet, not being in the general protoplasm and not in the seat of activity, are said to be secreted rather than excreted and are therefore waste to the plant. The oils in the orange and lemon are secreted in specialized glands well down in the epidermis, while the acids accumulate in the pulp outside of the seed vessels and away from the growing seed. Just as citric acid is accumulated in lemons, oranges, and allied fruits, so are oxalic and malic acid in apples and pears, and tartaric acid in the juice of grapes. In this group, we find alcohol obtained by fermentation resulting from the action of enzymes on the acids and sugars. Tea is the watery extracts of tannin from the tea leaf. These substances are waste products as far as the plant is concerned. They have no nutritive value to the plant; in fact are often poisonous.

Milky juices are very common excretions from plants. The Milkweed family is distinguished by a milky fluid which is stored in its vessels and exudes when cut or crushed. Upon exposure to the air this milky latex coagulates and forms, upon drying, a sticky, elastic mass which, in some plants is sufficinently abundant to furnish the India rubber of commerce. The rubber tree is a very large tree somewhat like the English ash and grows to a height of 60 feet. They are never found in groups. When a tree is about 20 years old, it is tapped. The tapping is done from the ground as high up as a man can reach and sometimes higher. This hole is not bored with an auger as in the tapping of the maple trees, but gashed with a hatchet just deep enough to cut the bark but not the wood. As the rubber gatherer draws out the hatchet a milky white fluid oozes forth. The tapper then inserts a little cup below the gash, fitting it by a slight cut in the bark. He makes at least three such cuts in each tree. Since these trees grow far apart the tapper must cover a great deal of ground in his daily work.

Each man has his own trees to care for ranging from 60 to 150 trees according to the distance between them, and this number is called a path or a road. The size of a rubber plantation is estimated by the number of paths or roads it contains. The roads are mere footpaths which lead through the forest from one rubber tree to another.

The sap flows most freely in the morning. By noon the rubber man comes back to empty the milk into a gourd or bucket. Only a few tablespoonfuls can be gathered from each wound in a day, and if he can gather two quarts of milk from his path he thinks he has done very well. The next process is turning the milky sap into the rubber of commerce. The sap coagulates upon exposure to the air. The fine rubber is cured by smoking, and the best rubber comes from the sap which is smoked a few hours after it is gathered. It will harden best under the influence of smoke. The fuel is usually palm nuts because they make a dense smoke. The sap is poured into a broad bowl and a long paddle is thrust into the milk. It is held in the smoke a minute and turned rapidly so that no drop of the precious sap may fall into the fire. This is repeated until a mass of rubber as large as a six-pound ham is formed. It is then cut through one side and the paddle is taken out. Now it is ready for shipment.

The solid loss to plants of winter twigs is incalculably more than is commonly supposed. Before leaf fall, all the trees form their winter buds in the axils of the leaves. After severe storms, twigs bearing these buds are broken off and scattered here and there and this is a loss to the tree. A solid loss of great commercial value is cork. Cork is the outer layer of bark of an evergreen or live oak, which grows in Portugal and Spain. When the tree is about seventeen years old, the first stripping of the bark takes place. Thereafter it is stripped every eight years until it is 150 years old. This operation is performed in spring when the sap is beginning to rise. It is advisable to put back the cork thus stripped, fastening it around the trunk by means of wire and leaving it there for a time; otherwise the trees are very liable to injury from dry, hot winds. Wrapping the trees in this way also prevents a second development of the worthless outer cork. The new cork is of great value. It is deposited at the rate of .04 to .12 inch annually. The first harvest is taken when the layer of cork has reached the thickness of an inch.



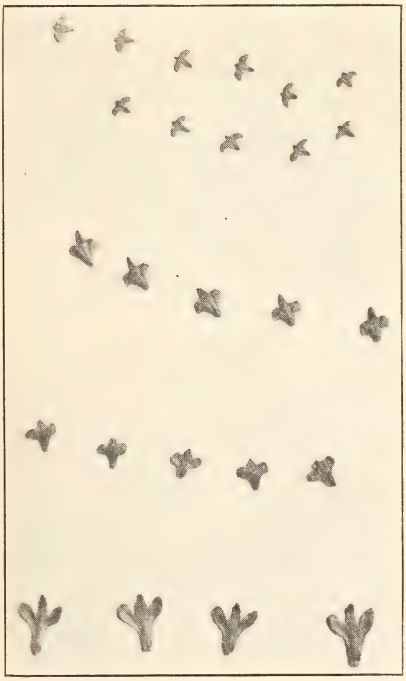
THE BIRCH HARVEST

By W. M. Buswell.

WHILE walking through the forest in late fall or winter, one may often notice that in many places the snow is thickly covered with small winged seeds and four-pointed scales from some nearby tree. If we happen to be familiar with the trees of our northern forests, we recognize these as the seeds and scales of the birch. Few, however, would know which of the four common species of birch had showered the white forest carpet with its fruits, for the trees from which they come are often many rods away and seemingly invisible.

I suspect the birds are responsible for many of these birch showers, for the fruit remains on the trees for some time and the birds probably know that such crops, like grain crops, should be harvested before falling to the ground. Since the fruiting branches of the birch are usually out of reach from the ground, it would be a considerable task to collect fruit from the tree, though the birds find it easy and many of them are fond of the seeds. While sitting under some white birches one day in October, a large flock of goldfinches were busy stripping the cones to get the seed, and so fast did they work that the continuous shower of loosened scales sounded like rain as they dropped on the leaves under the trees.

We often hear these birch scales compared to flying birds, yet there is only one species with truly bird-like scales. The scales of the small gray birch (*Betula populifolia*) do resemble a flying bird, as the illustration will show. The scales of the white birch (*B. papyrifera*) are the ones most often seen and are probably the ones referred to in this connection though they have much less resemblance to birds, either when falling from the trees or lying on the ground.



Seeds of gray, white, black and yellow birches, from top down.

The locality as well as the season should be considered in attempting to identify the birch fruits, for we rarely find all four species growing in the same place. Gray, white, and yellow, birches are found in the same locality and black, white, and yellow, may be found together, but gray, and black birches I have never found growing naturally in the same locality. Black birches (*B. lenta*) grow along the fertile river valleys while the gray birch seems to prefer a dry gravelly soil.

The fruits of the white, gray, and yellow, birches ripen in autumn and may remain on the trees well into winter, while the black birch fruit is ripe early in the summer and most of the fruit will be off the trees when that of the others is ripe. The scales of the yellow birch (*B. lutea*) are entirely different from other birch scales and have no resemblance to a bird. They are more like a flower petal with a long narrow base and wide, three-lobed tip. They are nearly twice as wide as the others also. The scales of the white and black birches are most alike in size and shape, but the tip of the white birch scale is narrow and pointed, with a wider base, and the wings usually have a backward curve toward the base. The scales of black birch have short, often blunt tips, as wide as the base but shorter, and the wings have a forward slant.

A birch shower in the fall or winter may originate in either the white or gray birch, but if both trees are present, a comparison of the scales will be sufficient to distinguish them. In a gray birch district, the scales (which are very small compared with the others) and their birdlike form will identify them. The seed of the gray birch is very narrow, the wings lighter in color and each two or three times as wide as the seed. That of the white birch is broad and oval with wide, pale yellow transparent wings, each wing about the width of the seed and not narrowed toward the base as in the black birch. The seed of black birch is broad and oval with wings narrowing toward the base making seed and wings together somewhat heart-shaped. Yellow birch seeds are oval, or nearly round with wings about half as wide as the seed. The gray birch is sometimes called white birch in books, though I seldom hear it called that in speaking of the tree. The bark has a smoky appearance, more of a gray than a white. Whatever the value of the birches may be when worked up into lumber or firewood, they all add much to the beauty of the forest, while growing.

OSWEGO TEA IN THE GARDEN

By Adella Prescott.

AMONG the wild flowers that may be easily grown in gardens, perhaps none is more attractive than the Oswego Tea (*Monarda didyma*), a showy member of the mint family that brightens our swamps and brooksides during the late summer with its graceful heads of bright, yet soft red flowers. It is beloved of landscape architects who are obsessed with a desire for solid blocks of color, because there are few flowers of that particular shade. But it loses all its poetic grace when too broadly massed and is much more effective scattered among shrubbery in a natural way, being massed very lightly if at all. It delights in rich, moist soil and partial shade but will grow after a fashion almost anywhere, though it is naturally much shorter when growing in dry soil, sometimes being scarcely a foot tall, while in low, damp woodlands it may reach quite three times that height.

But its greatest charm (for the writer at least) is its attraction for humming birds, who seem to find the nectar in the long tubes flavored quite to their taste and come many times a day to lunch on the dainty food. If the flowers are near a porch or frequented garden seat, the tiny birds will become so tame that they will alight on a twig to rest between sips with no appearance of fear. The cardinal flower is also a favorite with humming birds and may be planted effectively in front of the mint, thus giving variety that even to birds is the spice of life. Both of these plants may be raised from seed, but as the cardinal flowers insist on moisture yet "damps off" very readily, the problem of keeping it wet and dry at the same time is sometimes a perplexing one and not easily solved.

A USEFUL WILD FRUIT

BY CHARLES FRANCIS SAUNDERS.

SOME years ago, when visiting an old Franciscan Mission in Southern California, I cut a joint from one of the plants of a cactus hedge planted there generations ago by the Missionaries, and, bringing it home to Pasadena, set it out in my garden. It was of the Mexican species, *Opuntia Ficus-Indica,* the Indian fig or prickly pear, famous for its pleasant flavored, pyriform fruit. My single slab has now become a good sized plant and has proved an interesting addition to the garden, both because of its lovely flowers and its luscious fruit. The latter ripens in September, and, when mature, is 2 to 2½ inches in diameter by about 3 inches long, and of a pale straw color.

The outer surface of the "pear" is dotted at intervals of about half an inch with tufts of tiny bristles which, if touched even lightly, transfer themselves to the picker's fingers to his great annoyance. When handling the fruit, therefore, it is well to wear a stout glove; but, when growing high, it may be gathered, as is the custom of the Mexicans, with a pole to the end of which a nail is fixed transversely, acting like a hook. With this the fruit is spiked and pulled loose. The bristles are then removed by brushing with a bunch of grass or a piece of burlap, and with a knife a section is cut off each end of the "pear" and a narrow slice made vertically down one side. Then, by pressing back the enveloping rind at the vertical slice, the edible interior is neatly released. This is a juicy, sweet, refreshing pulp, about the size of a duck's egg, and only inferior to an equal amount of watermelon in the fact that it is pitted with numerous small, hard seeds, which are best spat out.

By pruning off the lower joints as the plant grows, the prickly pear may be trained into the form of a small tree, and is thus occasionally treated in the gardens of our Southwest. The plant as found growing wild on old Mission lands is sometimes procumbent as well as upright. Old plants are wonderfully prolific of fruit. I have counted thirty-four "pears" on a single joint. The Burbank spineless varieties in cultivation are similar to this naturalized child of Franciscan days in California, but of course the absence of spines and spicules makes the cultivated fruit more convenient to handle. The Mission Fathers introduced this species and another with red fruit, *Opuntia tuna*, both for hedge purposes and as a food item for their dusky protegés.

THE FLOWERS OF JAPAN

ONE may safely assert that no garden, large or small, in the United States of America is without its something "japonica". True, not all the plants bearing the name are strictly native of Japan, for the ignorance of botanists and others has resulted in many plant names being misnomers,—but that is another story. To the horticulturalist of this country, Japan is of peculiar interest, for not only has it furnished our gardens and greenhouses with a host of invaluable plants, but it is the only country of which the first fruits, horticulturally speaking, came direct to the United States. The gardens of this country secured the plants of most lands through Europe, and not only exotic plants, but a large number of North American native plants also. With Japanese plants, the case is different, thanks to Dr. G. R. Hall. It is well that garden lovers of this country should treasure the name of this gentleman for the plants he introduced,—*Lonicera Halleana*, *Magnolia stellata*, *Malus Halleana,* and others—are indispensibles. It was in March, 1862, that Dr. Hall returned from Japan and handed over his rich collection to Samuel Parsons at Flushing, Long Island, for propagation and distribution. But previous to this, Francis Parkman of Jamaica Plain, Boston, had received a consignment of plants from Dr. Hall, and among others was the famous *Lilium auratum* which flowered for the first time in America in July, 1862. In the early sixties, Thomas Hogg visited Japan in the interest of Samuel Parsons and introduced, in 1865, many plants, including *Magnolia obovata*.

Another American, Prof. W. S. Clark, who went from Amherst College in the early seventies, sent, in 1876, seeds of many valuable plants, such as *Magnolia kobus, Cercidophyllum Japonicum, Syringa Japonica, Actinidia Polygama*, etc. In the Arnold Arboretum, many fine specimens raised from his seeds are growing today.

Three Englishmen, John Gould Veitch from early spring to autumn, 1860, Robert Fortune from the autumn of 1860 to the summer of 1861, Charles Maries from 1877 to 1880 collected extensively in Japan and each added to our gardens treasures beyond price. During the same period and in the early eighties, various foreign amateurs in Japan sent to their friends in Europe such valuable plants as *Vitis Coignitiae, Prunus Sargentii, Rosa multiflora*, and *Rosa Wichuriana*.

The pioneer work was supplemented by Prof. Charles S. Sargent, director of Arnold Arboretum, who visited Japan in 1892. His predecessors in Japan had enjoyed a virgin field, but as an offset to this, Sargent had the advantage which the full knowledge of the subject gives. He knew not only the Japanese plants already in cultivation in the Occident, but was also fully acquainted with the whole forest flora of Japan, and the result was a great number of beautiful and hardy trees and shrubs added to our gardens. He introduced, among other plants, all the Japanese deciduous oaks, certain horn beams, birches, alders, and many other valuable plants. In fact, this journey was the most fruitful in results of any undertaken in

Japan. The flora of Japan is very rich in ornamental trees and shrubs and the majority of the deciduous plants and nearly all the conifers have proved perfectly hardy and amenable to cultivation in the gardens of New England.—*From an article by E. H. Wilson in Gardeners' Chronicle of America.*

REPRODUCTION IN TREES

ALTHOUGH the nurserymen make use of suckers and cuttings for the quicker multiplication of certain species, every tree in its natural habitat produces seeds and is reproduced by them. The flowering of our forest trees is a phenomenon that does not, as a rule, attract attention, but their fruiting or seed bearing becomes patent to anyone who visits the woods in autumn. A tree has lived many years before it is capable of producing seeds. The seed bearing age is different in different species; thus the oak begins to bear when it is between sixty and seventy years old; the ash between forty and fifty; the birch and sweet chestnut at twenty-five years. Some produce seed every year after that period is reached, others every second, third, or fifth year; others, again, bear fitfully, except at intervals of from six to nine years when they produce an enormous crop. Most tree seeds germinate in the spring following their maturity but they are not all distributed when ripe. The birch and aspen for example retain their seeds until spring and these germinate soon after they have been dispersed.

The seed contains sufficient nutriment to feed the seedling while it is developing its roots and first leaves. We can, of course, go further back in starting our observations of the life progress of the monarch of the forest. We can dissect the insignificant greenish flower of the oak when the future seed, the acorn, is but a single cell, a tiny bag filled with protoplasm. From that early stage to the period when the tree is first ripe for conversion into timber, we span a century and a half—

equal to two good human lives—and yet the oak is but at the point at which a man attains his majority. The oak is built up after a process by which man attains his full stature. It is a process of multiplication of weak, minute cells which become specialized for distinct offices in the economy of the vegetable community which we call a tree. Some go to renew and enlarge the roots, others to perfecting that system of vessels through which the crude fluid from the roots is carried up to the topmost leaf, whence after undergoing chemical transformation in the leaf laboratory, it is circulated to all parts of the organism to make possible the production of more cells. Each of these has a special task and it becomes invested with cork or wood to enable it to become part of the bark or the timber or it remains soft and develops the green coloring matter which enables it, when exposed to sunlight, to manufacture starch from carbon and water.

The tree, as we have indicated, gets its food from the air and the soil. The rootlets have the power to dissolve the mineral salts from the soil in which they ramify, some authorities believing that they are materially helped in this respect, so far as organic matter is concerned, by a fungus that invests them with a mantle of delicate threads. However that may be, the fluid that is taken up is not merely water, but water plus dissolved mineral matter and nitrogen.

At the same time that the roots are absorbing liquid nutriment the leaves, pierced with the thousands of little stomata or mouths, take in atmospheric air which is compounded chiefly of the gases nitrogen, oxygen and carbon dioxide. The leaf cells containing the green coloring matter, chlorophyll, seize hold of the carbon and release the oxygen. The carbon is then combined with the fluid from the roots by the vital chemistry of the leaves and is circulated all over the system for the sustenance of all the organs and tissues.—*From an article by W. B. Beach in Tree Talk.*

NOTE *and* COMMENT

Dormancy in Seeds.—The seeds of nearly all of the wild plants in the Temperate Zone have a distinct period of rest and usually will not grow if planted as soon as ripe. In the seeds of cultivated plants, this tendency is less marked, having been weakened by many years of selection. After a dormant period of a few months, most seeds are ready to resume growth, but a few require a much longer period of rest. Some persist in the dormant condition for years, though given every condition that other seeds require for growth. Unfavorable conditions may retard the sprouting of any seed, unusually low temperatures, being especially effective. It is reported that under low temperatures, wheat may remain dormant for several centuries. In the case of seeds which refuse to grow under the most favorable conditions, several causes for the prolonged dormancy are known. In some plants, even when the fruit is ripe, the embryos within are so undeveloped that they cannot sprout at once, but must first complete their growth. In this class are the seeds of ginkgo and several of the true flowering plants. In other species, the seed coats are so hard as to exclude the needed moisture for long periods. As might be expected, all seeds of this kind do not sprout at the same time; it depends upon how long it takes for sufficient water to soak in. Other hard seed coats retard germination by preventing the swelling of the embryo. If the embryos of such seeds are taken from the seed coats they will grow at once; otherwise they may remain dormant for several seasons. The seeds of *Alisma plantago* are of this type. Some seeds have coats that exclude oxygen and other gases and thus hinder the growth of the seedling. For a long time it has been known that certain seeds will not grow while exposed to light and that others are equally sensitive to darkness. These various delays in sprouting, though at first glance apparently harmful to the species, are not always so. If every seed grew the first season, it is quite possible that all the plants might be destroyed. A few seeds held over to other years gives the species several chances to survive. In such species, the seeds give a distribution in time similar to the distribution in space usually resulting from the production of such structures.

IDENTIFYING PLANTS BY CHEMISTRY.—At last, species making by fiat seems to be going out of fashion. It has been discovered by E. T. Reichert of the University of Pennsylvania that species and varieties of both plants and animals are sharply distinguished from one another by the structure of their molecules, and are thus easily identified by chemical means. Starch in plants, for instance, is known to consist of carbon, hydrogen and oxygen in six, ten and five parts, respectively. This gives a large number of atoms which conceivably may be arranged in a vast number of different positions and still have the chemical formula for starch. In animals, the haemoglobin or red coloring matter of the blood may theoretically exist in more than a million different forms and still be haemoglobin. When tested in various ways, the haemoglobin from each species reacts differently, and by means of these reactions, the student is able to recognize genera, species and even varieties. The study of starch in plants has given equally remarkable results. Each property of the starch grain, whether it be manifested in peculiarities of form, size, hilum, lamellation, fissuration, or reactions to chemical reagents, appears to be a specific character, thus allowing of the certain recognition of species; in fact, the author says, "It seems obvious that we have found a strictly scientific basis for the classification of plants and animals."

Rainfall Due to Forests.—Much has been written for and against the theory that forests affect the rainfall without any very definite conclusions having been reached. Instances are on record where the removal of the forests have caused the gradual drying up of a region, but this was ascribed to the accepted fact that forests retard the evaporation and run-off and their removal naturally affects the moisture. Whether they increase the precipitation is entirely another matter, and one that has never been definitely settled, though opinion seems pretty much against it. Long continued experiments in France, however, show that the average rainfall over a forest compared to that over adjacent fields is as 100 to 76. If further proofs of this nature are found, we shall have to modify our ideas as to the relation of forests and rainfall. There is still another and seldom considered way in which trees affect precipitation, namely by the condensation of fog and dew. In foggy weather the condensation is quite noticeable, but even when it is clear, more or less dew forms on trees and though the deposit for a single night may measure the merest fraction of an inch, in the course of a year it forms a considerable amount. Estimates based on the amount of dew deposited on a certain number of leaves in one night would indicate that the annual dewfall may be equal to a rainfall of nearly 30 inches—more than many agricultural regions receive in an entire year.

Migrations of the Bobolink.—The bobolink, being a lover of damp meadows, has for many thousands of years been shut off from our Pacific States by the barrier of the arid lands. At the present time, however, the progress of irrigation has established throughout the region fertile spots by way of which the birds can cross. Small colonies, therefore, are beginning to nest each summer on the western side of the dry country, almost to the coast of the Pacific. Apparently, however, the birds continue to migrate by their old route, going first north on their former track and then turning west instead of cutting straight across by the nearest way.—*Guide to Nature.*

QUINOA.—One will look in vain for the word quinoa in the ordinary dictionary, yet this is the name of a plant that is highly valued in certain parts of the world as a source of nourishing food. The quinoa plant belongs to the goosefoot or pigweed family (Chenopodiaceae). Practically all the plants in this group have insignificant flowers and the different species are often regarded as mere weeds, but it must not be forgotten that several are ordinarily cultivated as food plants. It is to this family that the beet, spinach, chard, orache and New Zealand spinach belong. The foliage of all of these is used as a pot-herb and several wild species serve as well, notably the lamb's quarters or redroot (*Chenopodium album*). The quinoa plant (*C. quinoa*) may also be used as a pot-herb, but it is chiefly valued for its large seeds which are ground into meal and baked in small cakes. The plant is a native of the Andes from Chili to Peru and is occasionally found as far north as Mexico. It grows two or three feet high and has considerable resemblance to the common pigweed. It may be added in this connection that the seeds of several species of *Chenopodium* are used in medicine, especially those of Mexican tea (*C. ambrosioides*) and worm-seed (*C. anthelminticum*).

ABSURDITIES IN NOMENCLATURE.—The complications which sometimes develop as a consequence of the changing of plant names by the scientist are sufficiently absurd to be amusing. A good illustration of this may be found in the name of a little fern, *Polypodium polypodioides,* which when translated means a polypody that looks like a polypody! Another good specimen culled from the pages of a recent American publication is *Unifolium bifolium monophyllum.* Students of dead plants and the dead languages will observe that the generic name means one-leaved, the specific means two-leaved and the varietal one-leaved. The odds seem to be two to one that the plant has a single leaf, but knowing the ways of the name-tinkers one can never be sure. Anyway, this seems a long way around a plant with only one leaf.

BRAWN VERSUS BRAIN.—Is there no significance in the fact that many of our colleges are better known through their foot-work than their head-work? Is it not significant that the Y. M. C. A.'s dotting our land are as strong in bowling-alleys as in education and that most of our religious training goes to the heathen? Is it a sign of health that so large a proportion of our newspapers are paid to feed us with results of useless experiments between prize-fighters? I think the stadium should be the accessory of the laboratory, not the temple of the oracle; and that in reality a research laboratory is more compatible with the object of a university than the more common training table. I do not mean to be too insistent as a critic or too pressing as an advocate, but I hate to see my own country such a trailer as it now is. I hope the conditions are changing, but I know they are not changing fast enough. All service is based on knowledge, and knowledge is an ever augmenting thing which almost anyone may increase. If the stock is *eternally* useful as it is, how great must be the value of the indestructible increments which anyone may produce. When so much of our material welfare, the condition and extent of our manufactures, the quality of our agricultural efforts, and the health of our people, depend upon the rate of our acquirement of new knowledge, there ought to be much greater effort made along the lines of research than is at present the case.—*From an article by Dr. Willis R. Whitney, in Science.*

FOOD OF THE JUNE BUG.—When the return of mild weather makes open windows again possible, about the first thing to follow the omnipresent fly into the house is the May-beetle or June-bug, a clumsy, big, brown, buzzing beetle that bumps about against the ceiling and ultimately falls into the lamp if this is possible. This interesting specimen is the parent of the white grub which one discovers so cunningly curled up in the soil when spading the kitchen garden. It takes the white grub two years to become a May-beetle, but it takes the May-beetle only thirty-one days to become a June-bug, an automatic advance, as it were, facilitated by the calendar. While the grub is growing up, it devours the roots and other underground parts of plants and is especially fond of potato and strawberry plants. In lawns and pastures, colonies of these grubs often ruin the soil over large areas. The adult beetles feed on the leaves of trees and show a decided preference for oak, poplar, apple, willow and hickory, though nearly all of the broad-leaved trees are attacked. An exception is made in the case of the box elder; even a June-bug has no use for that, though it does love that other tree-weed, the Carolina poplar. In Europe there are only two species of June-bugs, but when we go in for anything on this side, we spare no expense. The State of Illinois, alone, has thirty-four species. We have no record of the number in other States but have an idea that there are always enough to go around.

Leaf-Margin and Environment.—The beginning student of botany seldom regards toothed and notched leaf-margins as anything more than convenient means of identifying his specimens, but recent studies have shown the nature of the leaf-margin to be intimately related to the distribution of plants. A survey of the dicotyledon plants of the world shows an overwhelming number with entire leaf-margins in tropical and frigid regions, while those with notched and toothed margins, though represented in these regions, are much more abundant in temperate climes. Whenever a temperate flora contains woody species with entire leaves they are almost invariably extensions from tropical or cold regions. In the flora of the

North-eastern States, for example, the magnolia, catalpa, pawpaw, sour gum, red-bud, and others with this type of leaf, have pushed in from the South. The cause of entire leaf-margins seems to be found in temperature and moisture; regions that are either physically or physiologically dry and those in which great transpiration must occur produce the greater number of such forms.

Alkaloids of Belladonna.—The belladonna plant (*Atropa belladonna*) though very poisonous is highly regarded as a drug plant, being almost indispensable in dilating the pupil of the eye when an examination of that organ is necessary, and equally useful in other ways. The supply of belladonna, like that of most of our drug plants, has hitherto been derived from wild specimens, but an investigation of such material has shown that the alkaloid, the part effective as a drug, varies greatly in different plants. The question then arises, can the plants be bred up to produce not only a more uniform alakloid content, but a higher percent of this substance as well. This question the investigators in the national government service have answered in the affirmative. Analysis of wild plants showed a difference in alkaloid content of nearly 300 percent, and by breeding from the plants with the highest percentage of alkaloid, this amount was still further increased. Subsequent cultivation has shown that plants with a high alkaloid content have no tendency to deteriorate in this respect. Since the physician must depend upon the pharmacist for the drugs he administers it is highly desirable that a given dose shall contain the full amount of the principle involved. The production of drugs of known strength, therefore, must be a long step in advance of present methods.

Iris Bracteata.—The British Botanical Magazine for December, last, figures in color an interesting iris that does not seem to have come into cultivation on this side of the world, though it is an American plant. The plant is *Iris brac-*

teata. It was discovered in Oregon by Thomas Howell about thirty years ago. The flowers are clear, bright yellow with brownish purple or red veins on the sepals. Since yellow-flowered species are not common in the genus, the present species ought to be valuable as a starting point for other interesting forms.

Sense of Smell in Insects.—It would be impossible for anyone to say just how well the sense of smell serves the denizens of the insect world, but if the author of a paper recently presented before the American Society of Zoologists is correct, the perception of odors by the insects must be rather keen. Unlike the higher animals, the olfactory organs of the insects are located on various parts of the body, even on the legs and wings. It is reported that some butterflies and moths have from 500 to 1,300 olfactory pores, the moths usually having the larger numbers. Most of these pores are located on the wings. If they serve as so many individual noses, as they apparently do, the life of the insect must be largely dominated by odors. It would be absurd to assume that because we cannot detect odor in a flower that it is equally odorless to the bee or moth. It is quite within the range of possibility that many of the odors we are able to detect fail to register on the insect sense organs and *vice versa*. At any rate, an insect with 1,300 olfactory pores seems pretty well equipped for appreciating the odor of a flower if it has any.

New Forms of Lily.—The differences in color presented by the flowers of the meadow lily (*Lilium Canadense*) have long been a matter for speculation. In New England and other parts of the Atlantic Seaboard, the flowers are orange yellow; further west they are deep red. Up to the present, however, botanists have regarded one form as a mere color variation of the other, but Prof. O. A. Farwell considers the western form distinct enough to be regarded as a species and recently named it *Lilium Michiganense*. Since the color of the flower is the chief distinguishing characteristic, it is likely that a good many botanists will incline to hold to the old name or, if it is regarded as distinct, to call it the variety *rubrum* as the nurserymen do. If the writer's memory is not at fault the red flowered form occasionally occurs in New England. If so, there is still greater reason for calling one a mere color form of the other. The observation of New England readers on this point would be of much interest. In addition to the new species described, two forms are distinguished; the variety *umbelliferum,* with several flowers from the top whorl of leaves, and the variety *unifolium,* which bears a single flower. Still another plant with smaller leaves is named *L. peramoenum.*

An Insect Fungus.—Some of the most remarkable fungi in the world are found in the genus *Cordyceps.* They have the peculiar habit of developing in the bodies of insects. When a spore once gains admission to the body of a caterpillar, it begins to grow and ultimately the fungus replaces the animal's tissues with its own cells until what was once an insect is now a plant with an exact likeness to an insect. At this stage the fungus is called a sclerotium. It may remain dormant for some time, but when the proper season arrives it sends up a club-shaped or branched sporophore which produces spores to repeat the process. The species of *Cordyceps* are widely distributed. They belong to a group of fungi known as Ascomycetes and are therefore not distant relatives of cup-fungi, grape and lilac mildew and many other plant pests. In some parts of the world the sclerotia of the *Cordyceps* is used as food.

Producing New Varieties.—We have repeatedly pointed out that the production of new varieties is a comparatively easy matter. In this matter anybody can be a Burbank in his own back yard. This fact is beginning to receive attention from the nurseymen and florists as may be seen from the following note taken from the editorial page of *Horticulture:* "In his talk before the Horticultural Club of Boston, last week, W. A. Manda urged that the propogation of hardy garden herbaceous plants by seed should be more generally followed by growers in this country in preference to the more common method of root division. The result, Mr. Manda believed, would be in time a substantial increase in new forms and a general advancement in quality over the long cultivated types. Once a 'break' is started the progress of evolution would be startling. Many of our native plants, for example, still exist only in their primitive form although even in that stage they seem to suggest more promising possibilities than are apparent in the original wild chrysanthemum of China and Japan from which our highly cultivated varieties have been evolved. One need not think long nor deeply to conjure up wondrous things in imagination. There are plenty of subjects within the reach of any budding Lemoine well equipped with the required zeal, judgment, patience and—humility."

MAGENTA FLOWERS IN THE GARDEN.—An excess to which we are often impelled by this same innocent love of color, is the use of too many plants that have the strongest colors. One of the commonest complaints that ladies make is that "magenta flowers will not harmonize with anything in the house or outdoors, and we can't wear them." Gardening writers often express the utmost animosity against magenta, as if it were a bad color in itself. Is any color inherently bad, or is it largely a question of combination? Most of all the color discords in gardens are caused by the near-magenta colors, such as purple, crimson and crimson-pink. So notorious are these "troublesome colors" that careful gardeners have a rule not to buy a phlox, peony, iris, or chrysanthemum from a catalogue even when they are advertised as being delicate colors, like pink and lavender. Sad experience teaches that it is safer to select such varieties when they are in flower. If there is some plant of this color group which you love very much, can you not harmonize it by surrounding it with a white flowered variety, since white is the peace-making color among flowers? If not, it is easy to refine any near-magenta flowers simply by putting them in deep shade. But would the world come to an end if these "dangerous colors" were omitted altogether? What if a certain garden contained no cock'scomb, Joseph's coat, spider flower, blue hydrangea, purple althea, Douglas spiraea, Eva Rathke weigela, Anthony Waterer spiraea, or kochia? Would it be forever ugly or are there enough other flowers in the world?—*From "The Prairie Spirit in Landscape Gardening."*

EDITORIAL

Whenever this magazine fails to appear on the first of certain months—as is invariably the case—our newer subscribers begin to grow anxious and some are wont rather peevishly to inquire why the magazine does not appear with clock-like regularity. As a matter of fact the issues are supposed to appear on the twentieth instead of the first, but while we name dates on which the magazine may be expected, "we give no assurances, expressed or understood," as the seed catalogues have it, that these expectations will be realized. The clock-like regularity of appearance is merely a pleasant little fiction which is included with the price of admission. Most of our readers are aware that the magazine is issued primarily for the editor's amusement and everybody knows what happens when business and pleasure meet on the same track. Only the millionaire dares side-track business for pleasure and play golf when he ought to be keeping tabs on the cashier. A considerable number of people like the magazine well enough to exchange a dollar for it annually and a lot of them have been doing this ever since the first number appeared. We certainly appreciate their support of the enterprise, but until enough others add their support to enable us to secure a real editor on a real salary, the magazine must continue to come out as the present overworked editor can find time for it. Our old subscribers understand the situation and make allowances accordingly. That the magazine will ultimately appear is one fact that all can bank on. The editor has issued nearly fifty volumes without ever doubling up two numbers in one and thinks he has the hang of the business well enough to issue a few more after the same pattern. The only thing that gets on his nerves is for new subscribers to insist on having the January and March numbers of the magazine. He thinks they ought to know by this time that "there ain't no such animal."

* * *

The world has produced a number of individuals who have attempted to confer lasting benefits on posterity and made a muddle of it, but the one we nominate for the principal prize in such matters is the misguided individual mentioned in a recent number of *Torreya,* who goes about the country adulterating the flora with European material to the consequent confusion of all industrious plant geographers. *Torreya,* quoting from the *New York Times,* says of our hero that "ever since he was a boy he has delighted in transplanting the seeds of wildflowers and plants and trees, so that the growths indigenous to one section should find a home in another. He formerly took American seeds to European countries and planted them there, returning to this country with seeds from foreign lands which he planted in this country. In the Eagle Rock Park west of Montclair he has planted many foreign seeds, but most of his planting has been done in the woods of New York, New Jersey and New England. He usually goes on his walking trips carrying bags of seeds in his pockets. The seeds he tosses broadcast as he walks along. On his frequent railroad trips he carries seed from some foreign country in small packages wrapped in tissue paper. These packages, weighted with stones, he tosses from the train windows into the woods bordering the tracks." Hereafter when old Professor Dryasdust finds a new plant along the Atlantic seaboard, he will never be certain whether to write a long paper about the new discovery for the Botanical Society of America or to pull up and destroy the plant as a vile interloper. If we believed in reincarnation, we would be inclined to report that the fellow that sowed tares with the wheat is again in the land.

* * *

A friend of the magazine has called our attention to the fact that the twelve-volume set of books describing the works of Luther Burbank which we mentioned in a recent issue have actually been issued for some time, are beautifully printed and illustrated, and apparently well edited. We are not disposed to misrepresent the efforts of anybody to improve our plants and hasten to make this correction, though still of the opinion that the results of Burbank's work have been greatly overestimated. We shall hunt up a set of those books as soon as possible and discover for ourselves whether the volumes are as accurate as regards the facts as a work of this kind ought to be, the pages we have seen having given us some doubts on the score. Our informant, however, is one of the country's most erudite botanists and what he says usually goes.

BOOKS AND WRITERS

Mr. W. H. Blanchard, 5 Guernsey Ave., Montpelier, Vt , is desirous of notes on blackberries from the Southern States. Mr. Blanchard holds the world's championship for blackberrying since in the pursuit of his hobby he has followed on foot the zone of ripening blackberries from Arkansas well into Canada and has described more new species from New England and adjacent territory than the manual makers supposed grew in all America. Several of his new species have been described in this magazine. Our readers living in the South should correspond with Mr. Blanchard. There may be a lot of new species in their own locality and if so Blanchard is the man to discover it.

The publishers of Underwood's "Our Native Ferns" inform us that the work will not be reissued since the last edition sold very slowly. This announcement gives a side light on fern study that will be of interest to those planning books on ferns. As a matter of fact, the many popular books for the identification of ferns has afforded the public a short cut to the names, and the more formal text-books are no longer bought.

The "Botanical Textbooklet" mentioned in these pages some time ago, grew, by the time it was issued, into a pamphlet of nearly fifty pages with a single character key to twenty-eight families of plants and fifteen illustrations. The text gives the number of plants in the family, their distribution, their edible and other qualities and tells how to distinguish the different groups. It is not a botanical manual but as an additional help to knowing the plants will be found useful. It costs 25 cents or it will be sent free for the asking to new subscribers and to all who renew for two years in advance.

The late Judge Addison Brown, one of the authors of the "Illustrated Flora of the Northeastern States and Canada," left a considerable sum of money for the purpose of illustrating our wildflowers in color. The series is to be called "Addisonia." There will be four numbers a year, each with ten colored plates, and the price of the volume will be $10. This country certainly needs a work of this general nature, but it is evident that the promoters of the present scheme have no idea of making it popular.

"How to Grow Roses" is the name of a little book issued by the Conard & Jones Company, West Grove, Pa., which has attained the dignity of twelve editions, the latest of which, revised and enlarged, has just been issued. Though published by a company of rose growers and evidently designed to advance their business through increased rose-growing, it is, nevertheless, about the best manual for the lover of roses that we have seen. The title exactly describes the first part of the book which, in addition to discussing how to grow the plants, does not overlook what keeps them from growing, such as insect and fungous pests and the cold of winter. There is a descriptive list of 158 varieties of roses, lists of the best roses for different parts of the country, recipes for rose beads, descriptions of rose gardens, etc. The book has 120 pages and sells for $1. There are several colored plates and many other illustrations of desirable varieties of roses.

There is nothing especially new in the make-up of "Our Early Wildflowers," by Harriet L. Keeler, but the book, which is a small 16mo, is another of the "how to know" volumes destined to have a share in introducing the spring wildflowers to the novice. The species mentioned, about 130 in all, are arranged according to family and each has the usual description after which follows more or less information of an ecological nature. There are numerous good photographs of the plants described and many line drawings, the work of Mary Keffer. The author has made a curious misapprehension in one of the common names of the adder's tongue, spelling it faun lily. As a matter of fact its name is derived from the leaves, which are spotted like the coat of the young deer or fawn. The book is published by Charles Scribner's Sons, New York, at $1.25 net.

NOTICE.—This number was issued the first week in June and the next issue will appear some time in July. Though late, all the numbers will eventually appear.

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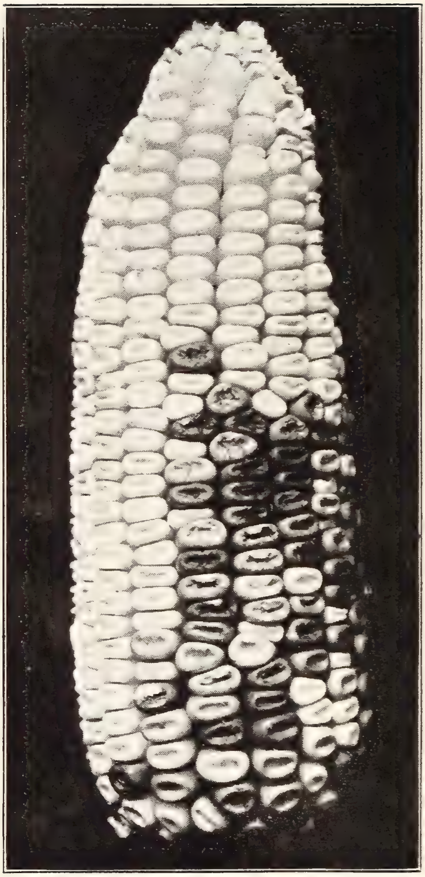


Xenia in Maize.

Smithsonian Institution
SEP 2 1916
National Museum.

THE AMERICAN BOTANIST

VOL. XXII JOLIET, ILL., MAY, 1916 No. 2

Amid the thousand blossoms of the lime
The gossip bees go hurrying to and fro,
And oh, the busy joy of working time,
And oh, the fragrance where the lime trees grow.
—Augusta Webster.

XENIA IN MAIZE

By Adolph E. Waller.

THE formation of the endosperm of a great many seeds from a triple fusion is a well known fact to all students of botany. When the contents of a pollen grain are discharged through the pollen tube, the first sperm fuses with the egg to form the embryo, while the second sperm unites with the two polar bodies, or polar nuclei, to form the definitive nucleus. This later becomes the endosperm tissue surrounding and protecting the embryo. It is here that a reserve supply of starchy material is stored. After the seed is planted and sprouting starts, the embryo draws on the endosperm for its food supply until the young plantlet can nourish itself.

The phenomenon called xenia is intimately connected with triple fusion. Xenia shows the immediate influence of the pollen in subsequent endosperm formation. If the second sperm from the pollen brings with it determiners for a dominant character that expresses itself in the endosperm, i. e. if pollen from blue flint corn is transferred to the silks of white dent corn, then the effect of the pollen is apparent the same year the cross is made.

The accompanying photograph shows an ear of corn with about one fourth of the kernels blue, marked off on one part of the ear. It was obtained by carefully dividing the silks and bagging the shoot. Two days later pollen from blue flint was placed on one part of the silks, the other being carefully protected with oiled paper. After forty-eight hours more the bag was removed and the shoot was allowed to be open pollinated with the pollen from the white dent of the field in which it grew. A blue kernel appears everywhere a silk received pollen from blue flint. Two blue kernels appear out of line showing the division not entirely accurate. There are also five white kernels in the blue area. But in the illustration a difference in the intensity of blue pigmentation causes some of the blues to look as light colored as the pure white, while in the original specimen the contrast between blue and white is more definitely marked. The misplaced white kernels are marked on the photograph. By exercising sufficient patience and ingenuity many rings or bands and stripes of color could be obtained, or particolored ears to suit the manipulator's fancy.

For the purpose of demonstrating the immediate effect of the pollen in this "manufactured" ear, blue and white were the contrasting characters chosen. Other characters that affect the color or texture of the endosperm could as well have been used. For instance pollen from field corn transferred to sweet corn or from corn with yellow endosperm to corn with white endosperm would have served the same purpose.

With three varieties, white sweet, yellow dent, blue flint, at his disposal, it would be possible for anyone to make an ear containing kernels of three colors and two endosperm compositions and of any design his imagination may suggest. Using the white sweet (both of these are recessive characters) for the carpellate parent and supplying pollen from all three varieties, blue, white, yellow, starchy, and sweet kernels could be formed. That triple fusion and xenia bear the relation to one another of cause and effect, but that not all triple fusions are followed by xenia could also be demonstrated by pollinating blue flint with pollen from white sweet.

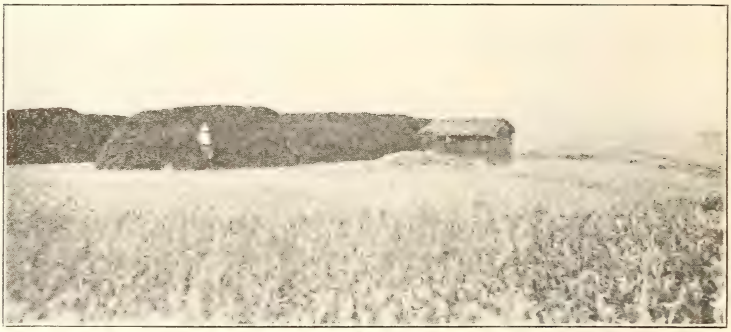
THE LICORICE PLANT

By H. E. Zimmerman.

MANY people who are now grown up remember that not so many years ago licorice root was a favorite commodity among the boys and girls of the public school. Because of its sweet and agreeable taste it was a common sight to see pupils with a piece of this root in their mouths, chewing one end of it. In those days country stores sold a good deal of licorice in this form to persons who enjoyed chewing it. Black licorice, in stick form, gradually supplanted the root form.

Botanically the licorice plant belongs to the legume or bean family of plants. It has long, pliant, creeping roots, and reaches a height of about three feet, and bears a small purple flower, which fills the air for miles with a sweet, heavy smell. It derives its name from two Greek words which mean "sweet root." The juice is used in medicine as an emollient and demulcent, and also for disguising the taste of nauseous drugs. It is also used to flavor snuff and tobacco. The plant grows in the East, especially in the territory of the Tigris and Euphrates Rivers. The first year's growth resembles a loosely twisted string of tow and may run to 20 feet in length. The second year it assumes a woody substance when dry, and the third year it becomes valuable. The time for digging the root is in the winter, when it is dried and crushed under heavy stones drawn round on it by mules, much like olives are crushed to extract their oil.

The plant grows wild, and some of the natives regard it as a pest. In the eyes of the Bedouins who transport the product by caravan to seaport, the root in itself is of no value except as it may be used to kindle fires. The industry is a great blessing to a comparatively poor region, requiring hundreds of natives to harvest and prepare it for shipment. The crooked and imperfect sticks are used for firewood, while the straighter and more perfect sticks are tied in bundles, to be shipped to America, the principle market for it.



Piles of Licorice Root.

The large pile of roots shown in the illustration was found near Antioch, Syria. It represents thousands of tons. Such gigantic piles of licorice root are to be seen all over Syria. The American Tobacco Company, the largest buyer of this root, owns the pile here shown.

VEGETATION OF THE HAWAIIAN SUMMIT BOGS

By Vaughan MacCaughey.

THE general geography of the Hawaiian Islands is well-known to the educated reader. The mid-Pacific location of this remote archipelago, its shining coral strands, the magnificent cloud-crowned mountains, the rivers of black lava, and fiery lakes of incandescent rockstuff,—these features have received wide publicity. The islands have been visited repeatedly by men of science and by exploring expeditions, and the distinctive characters of Hawaii's natural history are generally appreciated.

Undoubtedly the least-visited and least-known regions in Hawaii are the remarkable summit bogs. Altho of great geologic and biologic interest, their almost inaccessible situations, and the hardships incident to visiting them, have effectually deterred all but the hardiest of mountaineers. They are reached only by scaling dizzy ridges and dripping cliffs, perpetually swept by fog and rain, and often hidden for weeks together by their thick cloud-mantles. These high bogs are of particular interest to the naturalist, not only because of their unique topography, but because of the rare plants that occur in no other places. It has been the good fortune of the author to have made pedestrian journeys over all the larger islands of the Hawaiian group, and it is the purpose of the present paper to describe somewhat in detail these high swamp-lands, with their unique vegetation.

The general appearance of the Hawaiian bogs is similar to that of the bogs familiar to continental botanists. The soggy soil is covered with a thick vegetable mold of decaying turf and mosses, the soil proper being composed of disintegrated basaltic lava, varying in color from dark brown to pale gray. It is exceedingly fine-grained, like "adobe", and is very tenacious of its large water content. Under the stunted clumps of bushes and dwarf-trees, there is a considerable accumulation of dead branches and twigs in the mold; frequently this material is in an excellent state of preservation.

The surface of the bogs is covered with tusock-forming grasses, sedges, sphagamus, and other mosses. Abundant species are *Panicum isachnoides, P. imbricatum, P. monticola, Oreobolus furcatus, Carex sandwicensis, Deschampia australis, Luzula hawaiiensis,* and others. There is practically no standing water or pools, although the vegetation is water-soaked, and the rainfall excessive. The bogs are neither treeless, nor is there a continuous arborescent cover. Here and there are clumps of gnarled dwarf-trees, and these clumps occasionally coalesce into larger units.

Some of the distinctive smaller plants, in addition to the turf-plants already enumerated, are: the insectivorous *Drosera longifolia;* the elfin *Metrosideros pumila;* a number of endemic woody violets, *Viola;* a terrestrial orchid, *Habenaria holochila;* several *Lycopodiums;* several *Astelias;* several varieties of *Plantago pachyphylla; Wilkesia Grayana; Geranium humile; Lagenophora mauiensis; Acaena exigua;* and several woody *Lobelias.* The dwarf trees comprise a variety of genera and species; almost all of them are endemic, and the majority are highly precinctive. The *Vacciniums* are not abundant in the bogs; in Hawaii their zone of optimum growth is at a lower level than the bogs, and under conditions of lesser humidity. There are none of the pitcher plants, ericaceous forms, *Calopogons,* or *pogonias* of the continental bogs in the Hawaiian bogs.

There are six bog regions of importance, each situated on or near the summits of lofty volcanic mountains. Named in order, from west to east, they are: Wai-ale-alè, on Kauai; Ka-ala, on Oahu; Halawa Swamps on Molokai; Puu Kukui, E-eke, and Wai-a-napa-napa. on Maui; and the Kohal Swamps, on Kohala. There are also swampy areas on the slopes of Mauna Loa, Mauna Kea, and Hualalai, on Hawaii, but these lack the distinctive vegetation of the summit areas listed. These summit bogs all lie within the cloud zone, at elevations of from four thousand to seven thousand feet.

The Ala-kai Swamp, on the upper slopes of Mount Wai-alè-alé, Kauai, is unquestionably the largest, wettest, and most dangerous bog in the archipelago. Its elevation is 3500 to 5000 feet, and its occupies an area of some sixteen square miles. The treacherous morasses are fog-swathed almost continuously throughout the year. The total annual precipitation is enormous, indeed well-nigh incredible, and probably exceeds eight hundred inches (sixty-five feet). There are authentic U. S. Hydrographic Survey rain-gauge records of over 120 inches in a single month. The atmosphere, vegetation, and spongy soil are continuously saturated.

The quaking morass is covered with thin turf of alpine character, mosses, and stunted ligneous vegetation. In many places there is no solid ground, the quagmire trembles at every step, the hazardous trail is very indistinct, and a misstep plunges the chilled and water-soaked adventurer waist deep into the gray mud. Large areas of the bog are absolutely impassable. The prevailing temperatures are low, and a night spent near the summit is a chilling and thoroly uncomfortable experience.

The testimony of Professor William A. Bryan, who made extensive ornithological expeditions into this region, may be taken as representative of the hardships encountered by everyone who has attempted this dangerous country. He states (Natural History of Hawaii, p. 107), "The writer, with an experienced native guide, spent three weeks in the region . . . and amid chilling rains and bewildering fogs made an expedition extending through four days over miles of quaking moss-grown bog to . . . the summit of Waī-aleale. We were never out of the dense fog during the expedition, and that we returned to our camp and the civilization at all has always seemed little short of the miraculous . . . Our chief concern was to locate reasonably solid ground, a necessary precaution that entailed many weary miles of wandering in the wierd moss-grown wilderness."

This vast bog is an inexhaustable reservoir for all the leeward streams, and has given them the material for cutting the great canyons of southern Kauai. A considerable portion of the island eight to ten miles south of the bogs is thus abundantly supplied with water at all times. In a similar manner the bogs of Molokai and of Kohala are the headwaters of important streams.

The plant life, although stunted and windswept, is diversified. A high percentage of the species and varieties are endemic. A number of the varieties are bog forms of species that are abundant at the lower levels. The lehua (*Metrosideros polymorpha* Gaud), which in the forests of Puna is a magnificent tree towering to the height of 125 feet, on the summit of Wai-aleale is a stunted shrub, or even a prostrate creeper among the sedges. The native name for a portion of this swamp is *Lehua makanoe,* which means "the lehua tree in the fog."

In his monumental treatise on "The Unwritten Literature of Hawaii" (Bureau of American Ethnology, Bulletin 38), Dr. N. B. Emerson gives a translation of an ancient *mele* which contains so much of interest, that it is presented in part:

> "Wai-aleale stands haughty and cold,
> Her lehua bloom, fog-soaked, droops pensive;
> The thorn-fringe set about swampy Ai-po is
> A feather that flaunts in spite of the pinching frost.
> Her herbage is pelted, stung by the rain;
>
> Bruised all her petals, and moaning in cold
> Mokihana's sun, his wat'ry beams."

Commenting, he says, the "summit, a cold, fog-swept wilderness of swamp and lake, beset with dwarfish growths of lehua, is used as the symbol of a woman, impulsively kind, yet in turn passionate and disdainful. The physical attributes of the mountain are ascribed to her, its spells of frosty coldness, its gloom and distance, its fickleness of weather, the repellent hirsuteness of the stunted vegetation that fringes the central swamp . . ." The *mele* is indicative of the intimate knowledge of these summit bogs possessed by the ancient Hawaiians, and to this day the only reliable guides are the few remaining old-time Hawaiians.

Oahu has only one very small bog, located on the summit of Ka-ala, in the Waianae Mountains, elevation 4030 feet. This range is very old and has suffered great erosion and degredation. Unlike Kauai, there are practically no uplands. The summit ridges are exceedingly narrow, the comb of the ridge averaging less than six or eight feet in width. From the lowlands the summit of Ka-ala appears tabular, but this is an optical illusion. The bog is only a few square rods in area, and is abruptly bounded by extensive precipices. The soil is a deep, spongy peat mold, interlaced with tree roots and decaying branches. The trees are stunted, wind-swept, and very old. The lapa-lapa tree (*Cheirodendron platyphyllum* (Hook. & Arn) Seem.), is a distinctive species of this swamp. All of the woody vegetation is covered with saturated clumps of epiphytic mosses, liverworts, lichens, and ferns. The general impression is that of senility. There are many indications that this is the "last stand" of what was at some former time a much more extensive bog. The heavy precipitation that maintains the swamp is at the same time slicing away its margins. In a comparatively short geological period the summit bog of Ka-ala will vanish entirely, as has that of the degraded Ko'o-lau Range along windward Oahu.

Molokai is a long, narrow island, forty by ten miles in extent, with the long axis due east and west. Like Oahu and Maui it is a volcanic doublet, the two cones having appeared at widely separated periods of volcanic activity. The western cone is dry and barren, rising only to a height of 1382 feet, and is largely covered with introduced ranch grasses. There is no forest and no swamp land.

The larger eastern dome presents a striking series of contrasts with its western associates. It rises to a height of nearly 5000 feet. The long windward face is marked by stupendous precipices and deep valleys. The scenery is of heroic proportions. The summit has been eaten away by the great ampitheaters of erosion, like Ka-ala, so that in the heart of the mountains occur precipices literally thousands of feet in height. The crown is covered by dense jungle forest. The high flatlands at the head of Halawa Valley are cloud-capped and boggy. These Halawa bogs correspond topographically and biologically to the summit bogs on Wai-aleale and on West Maui. They cover an area of several square miles. The bogs are bounded on all sides by enormous precipices; the eastern cliffs are marked by the beautiful waterfalls of Moa-ula and Hi-pua-pua.

The Molokai bogs exhibit many features common to those of Kauai and Maui. The lava soil is hidden under deep layers of water-saturated mosses and decaying vegetation. The arborescent growth is sparse and stunted, and bears all of the ecological earmarks of its cold, foggy, humid habitat. There is a large number of precinctive species and varieties. Like Wai-aleale, many parts of the bog are practically inaccessible. The introduced goats and deer that have ravaged the lower forest levels are unable to live in this water-soaked highland, so that the flora exists in its primitive condition.

There are two summit bog regions on the island of Maui. West Maui, which is deeply eroded, is crowned by *Puu Kukui* (5788 feet). On a narrow summit ridge, a mile and a half to the north of this peak, is an ancient tufa crater basin, *Eeke*. The saucer-shaped interior of this crater, and much of the narrow summit flats between it and Puu Kukui, is boggy. The vegetation is strikingly similar to that of Wai-aleale. Puu Kukui rises directly above the great amphitheater of Iao Valley. Eeke hangs on the verge of a similar valley bowl, Wai-hee. The torrential rains that have so enlarged the valley heads, maintain the elevated bogs. Although difficult of access, these bogs have been frequently visited by scientists, and their floral and faunal contents are better known than those of Molokai or Kohala.

Of comparatively recent exploration are the boggy flats that lie at the extreme head of Kipa-hule Valley, on the eastern slope of East Maui. A small lake, Wai-a-napa-napa, occurs in the midst of these high swamps, at an elevation of eight thousand feet. The general aspect of the Wai-a-napa-napa swamps is similar to that of Molokai. The entire windward slope of the Hale-a-ka-la calderon is characterized by torrential precipitation. A large part of the upper jungle forest is inaccessible unless the party is equipped with machetes and axes. The complete exploration of this deeply eroded and densely vegetated area lies in the future.

The only summit bogs on Hawaii occur in the Kohala Mountains, at the northern extremity of the island. This range is of great geologic antiquity, and undoubtedly existed long before the formation of the vast volcanic domes that lie to the south and now dominate the island. The island of Kohala probably existed as such,—and much larger than the present Kohala Range,—simultaneously with the island of

West Maui. As with all Hawaiian mountains, the rainfall is very heavy on the windward, northeastern, slope, averaging 300-400 inches. The leeward side is semi-arid below the 1500 foot contour. The swamp lands lie along the rounded summit, —5489 feet,—and occupy an area of several square miles.

Numerous disintegrated cinder cones and volcanic blowholes give evidence of the prehistoric activity of this cloud-swept morass. Some of the vents are eight to ten feet in diameter and several hundred feet deep. As the mouths are invariably masked by luxuriant vegetation, they are veritable pitfalls, and require constant vigilance on the part of the explorer. The dense forest growth and thick layers of mosses and ferns now effectually hide the great majority of these volcanic vestiges. Prolonged erosion has carved enormous valleys,—Wai-pio, Wai-manu, Ala-kahi,—back into the very heart of the mountain. Beautiful waterfalls drop a sheer fifteen hundred feet down the vertical walls of these gigantic amphitheaters. Just as on the other islands, the swampy flatlands that crown the valley walls are densely covered with stunted hydrophytic vegetation. The dwarfed trees are clad with epiphytes,—mosses, liverworts, and ferns predominating. The beautiful indigenous lobelias of the genus *Clermontia* constitute a characteristic feature of the Kohala swamps, and are represented by a number of species.

SOAP FROM WILD PLANTS

By Charles Francis Saunders.

NATURE evidently intended man to be cleanly, for long before the invention of soap she had stocked the earth with plants capable of being used as soaps and quite as effective as the manufactured article. In the United States alone there are half a dozen genera of native plants which contain saponin in sufficient quantities to make them capital detergents. They are most numerous in the arid Southwest and on the Pacific Coast, and are variously known as soap-weed, soap-root, soap-plant and *amole*—the last being the name given by Spanish-Americans. Botanically these plants are indigenous species of *Cucurbita, Ceanothus, Chenopodium, Chlorogalum, Yucca* and *Zygadenus,* in addition to which an Old World species of *Saponaria* is represented in the herb Bouncing Bet, which, originally cultivated here as a garden flower, has now become a naturalized escape in many parts of our countryside.

Of these soap plants it is usually the root which is used, and all that is necessary to do is to dig this up, rinse it, crush it somewhat, and rub it briskly between the hands in water, when a lather is produced which quickly cleanses the skin leaving it agreeably soft. In the case of several species of *Ceanothus,* which are particularly abundant in California, the flowers and the green seed-vessels may be used with like effect. These shrubs are known as wild lilacs and during their season of bloom covers entire hillsides in places with a delicate veil of color. There is one species of *Ceanothus* (*C. Americanus*) indigenous to our Atlantic seaboard and known commonly as

New Jersey tea. It possesses the same saponaceous property. Perhaps the most interesting of our soap-weeds is *Chlorogalum pomeridianum,* a bulbous lily-like plant of the Pacific Coast, which presents its soapy offering in a particularly neat manner. The bulb is the part used, and this on being dug up is found wrapped in a loose jacket of coarse fibre, which may be readily stripped off, taking all stains of earth with it and leaving a clean, moist ball of "soap" for instant use.

Ceanothus or wild lilac.

The saponaceous character of most, if not all, of these plants was thoroughly understood by the Indians, and certain tribes in the Southwest employ them to this day in their ablutions, particularly in the purification preparatory to religious rites—the use of commercial soap in this connection being considered inadmissible.

REGENERATION IN ELODEA

By N. M. Grier.

DURING the past year, the writer, while observing the growing of *Elodea* (*Philotria*) *canadensis*. Mchx. in a laboratory aquarium, was led to note the apparent regularity with which buds and adventitious roots made their appearance upon the plant. Of 61 cases examined, it was observed of the roots that in no case these appeared less than 7 nodes apart, nor more than 13, 11 being most common, and the average number being 10. It was thus apparent that root-forming material was localized.

This led to speculation as to what portion of the plant would be able to act as a unit organism if judged by the capacity to produce roots and buds when detached from the parent organism. Accordingly, a series of experiments were made in the procedure to be described. By means of sharp, sterile scissors the plant body above the anchoring roots and junction of the branches was divided into 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 segments respectively, and grouped as such, care being taken to cut above and below the leaves of each terminal whorl when possible to prevent the probability of any damage to these. Five cuttings of each were taken, and each placed in a stender dish of appropriate size in water obtained from the same source as that in which the parent plants were growing. The experiments extended about a month, and the results obtained in that time are best presented in the following table:

Group	Number Surviving Operation	Number of Buds Formed in Group
I	0	0
II	1	1
III	1	1
IV	2	2
V	4	2
VI	4	3
VII	5	3
VIII	5	4
IX	4	4
X	4	4

Upon examining the above table, it will be observed that the number of buds formed in each group tends to substantiate the fact that at every ten segments, (as was found to be the *average*), the bud elements are located. Thus group I taken as a whole containing 5 segments could not be expected to produce any buds, group II in all 10 segments, could be expected to produce 1, group VI consisting of 30 segments would most probably produce 3, etc. The discrepency in group 10 may be explained by the fact that immediately after sectioning, the 5th member of that group commenced to disintegrate, as was also the case of the non-surviving member in group IX.

It will also be noted, that the greater the number of segments represented, the greater the chance of survival of that particular piece, but that survival does not always imply that vegetative buds will be formed, as to be seen in the cases of groups 5, 6, 7, 8. Some pieces of these groups are as green today as at the time of sectioning, but show no vegetative tendencies. It seems probable to the writer that under ordinary conditions pieces consisting of 10 nodes represent the minimum size of plant at which the activities of the parent organism are duplicated, and this statement seems warranted by the fact that in those pieces of less than 10 segments, an advanced state of development of the buds usually resulted in the death of the parent section, due probably to the withdrawal of nourishment.

The development of buds was always immediately succeeded by the formation of roots adjacent to them and later, opposite.

In some cases 3 or even 4 roots were formed, but never more than one bud in these experiments. There appeared to be some degree of polarity in that the buds were formed slightly superior in position. The first roots, while at first positively heliotropic, and at first produced at right angles to the stem, shortly afterwards curved in under the stem and away from the light.

The fact that at the base of each new bud roots appeared might indicate that the localization described would be of use to the plant, especially since under ideal conditions, the stem tends to become brittle, and that there is a tendency for the stem to die away beneath the branches, although it should be remembered that the habitat of this particular form—in slow streams and ponds—is such as would preclude the probability of any constant strain making these properties useful.

A NEW SPECIES OF ALLIUM

By J. M. Bates.

IN June 22, 1906, about four miles southwest of Grand Island, Nebraska, I collected a lavender-pink form of *Allium* which at the time did not greatly interest me. I had found *Allium Canadense* rather common in the vicinity with the usual bulblets and considered this simply a sport of the black-seeded type. In 1907 I found it at Wood river, 16 miles west, and named it *A. Canadense*. In June, 1910, I found it in perfect condition with lavender flowers in the railroad yards at Hastings where it was evidently introduced. My attention was now fully engaged. I carried the bulbs to Red Cloud and planted them in two gardens for study and for the enjoyment of its beauty. Later I found it at Havelock, ten miles east of Lincoln, and at Walton and Weeping Water, east of Lincoln, and on July 2 my son collected it for me eight miles west of Lincoln. With this distribution it is certainly noteworthy that our botanies make not mention of so beautiful a thing. I have sent it to Dr. N. L. Britton to be grown in the New York Botanical Gardens.

Allium Lavendulare N. Sp.

Larger plants two feet high. Bulbs, covered with network, the largest ⅞ of an inch in diameter. Leaves flat, 2 4/12 wide, more than half as long as the scrapes. Heads from 1½ inches to 2½ inches across, densely flowered. Bracts 3, broad, abruptly long acuminate. Perianth segments lavender, 4/12 long, acute. Capsule not crested, obovate, flattened. In sandy to very rich heavy soils. Closely related to *Allium mutabile,* Michx. It does not grow with that plant but occupied the ground by itself. Some would call it merely a variety of *mutabile.* It is simply a point of view which is constantly changing. I publish it in this way to call attention to a plant worthy of cultivation. The delicate lavender fades into pink with age and upon drying in press.

PLANTS AND ANIMALS FUNDAMENTALLY ALIKE

FUNDAMENTALLY, plants and animals are very much alike. I mean the resemblances are much more basic than the differences. The latter, very conspicuous to the eye, may be regarded as differences of degree, rather than of kind. Of many of the lower forms of life, it is still very difficult to say whether they are plants or animals; of the whole group of bacteria for example. For the primitive doubtful forms of life you will recall that Haeckel created the special kingdom of Protista. To my mind a fundamental unity runs through all living things from the lowest to the highest like a gold thread through a tapestry. For one thing, all are *alive;* all possessed of that unstable equilibrium of forces expressed by the words *growth* and *decay.* These phenomena are the properties of a substance called protoplasm. In both plants and animals this substance is organized into the form of cells. In both, usually, it is the outer protoplasmic membrane that controls the passage of *ions,* the disassociated electrically charged elements of water and other compounds. The same wonderful process of cell multiplication by *mitosis* occurs in both plants and animals. In both, except in the lowest forms, these cells are organized into *tissues* with *division of labor.* In both, there is a *sexual method of reproduction.* Plants, indeed, propagate also non-sexually by *budding*, but so do many of the lower animals. In many plants there is *regeneration* when parts are cut away, but so there is in a great variety of animals. Even their foods are not different. It is true, the plants differs decidedly from the animal in possessing an apparatus for elaborating inorganic substances into starch, sugar, and proteids, which the animal consumes, but it makes these substances for its own use, not for the animal. It is sometimes assumed that the inorganic substances, of earth, air and water, are the food of the plants, but such is not the case. The plant depends for its growth on the same nutrient substances as the herbivorous animals, viz., on starch, sugar, and proteid, which it has stored in every seed and under every growing bud. The phenomena of birth, growth and decay are essentially the same in plants and in animals; but corresponding to higher development, the animal has many special organs either wanting altogether in the plant, or greatly simplified; it also has flexible cell walls while the plant has rigid cell walls. But both plants and animals *respire*, both *assimilate* food substances and *oxidize* them with resultant work; both require about the same amount of water and mineral salts; both have a *circulation* of fluids and both *secrete* and *excrete* a variety of substances, acid, alkaline, and neutral. The response to stimuli, such a gravity, heat, light, radium, X-ray, electricity, and poisons, is much the same in both groups. In irritable response, plants and animals both obey Weber's Law; that is, to increase a response in an arithmetical ratio, the stimulus must be applied in a geometrical ratio. There is a suggestion, even, of a nervous system in plants since stimuli are passed along certain channels to distant organs, and the movement can be slowed down by cold, increased by heat, or inhibited by poisons applied midway, the response, according to Bose, being not simply hydro-mechanical. Even the idea of locomotion does not distinguish animals from plants. Many of the lower animals are rooted fast, while many of the lower plants have swimming organs and are actively motile. Moreover, all of the higher plants, change position more or less; all are sensitive; all show rythmic movements. Finally, the intimate cell-chemistry of the two groups (production of digestive enzymes, and the amino-acids, etc.), so far as known, is much alike.—*From an article by Dr. Erwin F. Smith in Science.*

Applied versus Pure Science.—The antithesis between applied science and pure science is sometimes emphasized to the point of bitterness. The only salvation in the situation is that society as a whole overcomes some of the narrowness of its individual members. The chemical researcher is supplemented by the practical man who dyes cloth and tans leather and makes sugar. Society is gradually evolving special agencies to help her in overcoming the narrowness of specialists. She is evolving specialists whose business it is to bring to narrow-minded practical workers the results of the researches of narrow-minded students of science. These middlemen are sometimes unable to get the sympathy of either group whose efforts they are trying to unify.—*Judd*: *Psychology of High School Subjects.*

NOTE *and* COMMENT

A Private Public Park.—Curtis G. Lloyd, of Cincinnati, Ohio, a sort of Elbert Hubbard among students of fungi, with a leaning toward puffballs and shelf fungi, has recently purchased a picturesque tract of land near his home town and turned it over to the public for a picnic and recreation ground. Unlike the average millionaire who gives a park to his city, Mr. Lloyd seems to have no desire to make the public contribute in some measure to his benefactions, and not only proposes to look after the upkeep of the park himself, but has provided for a continuance of this service after he has removed to more flowery fields. In the same manner he and his brother, John Uri Lloyd, have provided for the perpetuation of the Lloyd Library and Fungus Museum which occupies two three-story buildings in Cincinnati. The people of Cincinnati are fortunate in being able to number such men among their citizens. The kind is far from common. Some day, other men with money to spare will awake to the fact that there are other ways of benefiting the public besides contributing to colleges, churches, and hospitals, worthy though these latter may be.

Age of Concord Grape.—Some things seem to have existed from the beginning of time, simply because we have always been accustomed to seeing them. One of these is the Concord grape. This grape is probably more largely grown in America than any other variety, though its predominance is of comparatively recent date. The oldest Concord grape vine in existence is much younger than many persons now living. It is, in fact, less than seventy years old. The Catawba grape is nearly fifty years older but it never attained to the Concord's popularity. The grape, however, is not an isolated case. When we begin to inquire into the history of almost any of our varieties of fruit, we find that all are of comparatively recent origin. The varieties in cultivation a hundred years ago were seldom up to the standards we hold at present. Probably the fruits of another generation will in their turn excel those which we regard so highly.

VARIETIES OF GARDEN FLOWERS.—The conservative botanist is not the only one to complain of the undue multiplication of varieties. The gardener, like his scientific confrere, is beginning to find the flood of new forms somewhat embarrassing and objects to many of them as trivial variations of no value to anybody. In the *Modern Gladiolus Grower,* one nurseryman voices his complaint in part as follows: "Take any catalogue that describes a long list of varieties and one of experience cannot select the best by the descriptions, for all are described in such a way that they appear to be good and we might say extra good. If one of experience cannot select the best, how is the average amateur going to select them? I formerly had the mistaken idea that the more varieties the catalogue contained the better, but now I believe the fewer the better, provided they are the best obtainable. If I ever issue another catalogue I shall have fewer varieties, but those the best of their color. The past summer I compared my irises when in bloom with this end in view. I now have twenty varieties of German Irises in my catalogue that are blue of different shades and markings and my next catalogue will contain but four or five. What is true of the iris is true of most flowers, but probably peonies are the most abused of all flowers in this respect. I have over 150 varieties of peonies and if three-quarters of them had never been named they would not have been missed. If this is true of 150 varieties then how is it with the party who advertises 1,200 varieties and then has the audacity to say 'all good ones' "

YELLOW FRUITS.—One is warranted in expecting yellow-fruited forms of all fruits that are normally red, just as he is justified in expecting white-flowered forms from those with ordinarily blue or red blossoms. The occurrence is a sort of recession on the part of the plants and appears to be due to a lack of the determiner that causes the deeper color to develop. Mr. D. J. Talcott writes of finding yellow fruit of the red-berried elder (*Sambucus racemosus*), *Viburnum opulus,* and *Actaca rubra* and notes that the golden queen raspberry is a sport from the cuthbert red. To this list the writer can add yellow fruited holly (*Ilex opaca*) and winterberry (*Ilex verticillata*) and yellow tomatoes are common. It would be interesting to make a complete list of the fruits of this kind and we shall be glad to note any other instances that may be called to our attention. Black fruits may sometimes have red-fruited forms, but it is usual for fruits of this color to produce white forms. White blackberries, white or pink blueberries, and other white fruits are well known.

VARIATION IN THE RATE OF EVOLUTION.—A great deal of botany at present becomes a subject for elucidation by the philosopher. It no longer is thought to be mere chance that determines whether a given plant family shall number trees among its species, or consist only of herbs. It has been pointed out by E. W. Sinnott in an address before the Botanical Society of America, that the rate of evolution must be very different in trees and herbs. Herbs with the very brief period from seed to seed are able to accumulate changes much more quickly than can the slower growing trees and shrubs. New species, and even new genera, therefore, arise more quickly among the herbs, and yet, while these plants often have numerous species in the genus the woody plants are said to out-number them the world over. In order for the slowly changing trees and shrubs to produce so many species, a long period of time must have been necessary, and this suggests that the tree groups are much older than those containing only herbs. The fact that trees change more slowly than herbs is reflected in the catalogue of every nurseryman, for there are always a larger number of varieties catalogued for herbs than for woody plants.

CAUSE OF LEAF MOVEMENT.—A large number of plants are able to make changes in the position of their leaves as circumstances warrant. In many cases these changes seem directed by something akin to intelligence, though explained in other ways. One of the commonest instances of this is found in the sunflowers, whose leaves, and often the flowers, turn toward the sun all day. In the so-called "sleep" of plants the leaves or leaflets usually fold together though the plants do not sleep in the accepted sense of that term. Still another set of movements seem connected with evaporation. On a hot, dry day, the leaves of corn roll up, the compass plant sets its great leaves on edge and the leaves of many other plants, especially those of the Leguminosae, assume positions that ensure a reduced evaporating surface. An investigation of such phenomena has shown that such changes are entirely automatic and are produced by the very condition which the leaves seek to avoid. When one side of a thin board begins to dry out, the fibers contract and in consequence it warps or curves toward the dry side. In a similar way leaves may lose enough water from the upper surface to cause the whole leaf to roll up. In cases where the leaf changes position without rolling, some special part of the petiole usually reacts to evaporation. Changes of this kind may be produced artificially by the application of some drying agent, like alcohol, to the surface of the leaf.

Double White Trillium.—Mr. D. J. Talcott, Madison, Ohio, sends us a remarkable double flower of the large white trillium (*Trillium gradiflorum*) which consists entirely of petals—twenty-one in all. Not only have all the other floral parts been turned into petals but the flower has acquired two extra whorls of three parts each. The whole flower is quite rose-like and would make a desirable addition to the garden. The rhizome which produced this specimen bore two other flowers of the same kind and was found in a colony of the regular type. Mr. Talcott writes that he has experimented with trillium rhizomes and finds that they will grow from divisions as readily as irises do.

Colors in Wild Lilies.—The article in the February number of the *American Botanist* concerning the meadow lily (*Lilium Canadense*) is of much interest to me, as in my field study I have found the same variations in color and form in the wood lily (*Lilium Philadelphicum*). This is also called by Gray, wild orange-red lily from its color. The variety *andinum,* which he locates farther west, is quite abundant in swampy woods or thickets near the other on the island of Marthas Vineyard, Mass. This latter variety usually grows taller, has one or three or sometimes as many as four blossoms of a beautiful deep red shade at the top of the stem.—M. [If the wood lily varies from red to yellow, this would seem to be an added indication that the meadow lily's change of color is not a specific character. More observations on this color of *Lilium Canadense* are needed.—Ed.]

Nature Versus the Gardener.—I wish more things were like the English sparrow. How it thrives although every man's hand is against it. But we must spray fruit, and use serum on meat animals and doctor the soil which produces the cereals. It always pleases me to visit a patch of wild plums; they get along without bothering anyone. What a fight man is compelled to make for the apple, and what a free gift the wild plum is! I lately rode through the country in an automobile and the road was lined with wild crab-apple trees. They were in full bloom and very beautiful but no one had sprayed them or trimmed them: they were a free gift of nature. Are the English sparrows, the wild plums and the wild crab-apples so healthy because they have never been reformed? —*Ed Howe in The Independent.*

When to Gather Cattails.—The rich brown floral spikes of the stately cattail flag, common everywhere in marshy lands, are a great temptation to bring indoors for home decoration in the autumn, but the fluffing of the heads destroys their beauty, as well as makes trouble for the housewife. This fluffing is due to the cattail being gathered when too mature. If the stalks are cut early in summer, immediately upon the spikes turning brown, it will generally be found that they retain their beauty indoors throughout the winter.—S.

Snow as a Plant Protection.—Reports from various sources indicate that not for many years have the spring wild-flowers been so abundant or so beautiful as this season. Trailing arbutus has rarely been so perfect in foliage and purity of color. Violets, bloodroot, hepatica, spring beauty and other gems of the woodland seem to have found the peculiar characteristics in the weather of the recent winter and spring greatly to their liking, and in our gardens the same healthy vigor and profuseness of bloom is in evidence among all the low-growing spring flowering border plants. The reason for it all is easily discerned in the deep snow which this year covered so large a section of the country and protected these things against the ferocity of the February and March weather. In many of the spring flowering garden shrubs, it is interesting and instructive to note the well-defined line of the snow blanket, flowers being produced in profusion on the lower branches of forsythia and azaleas of the Daurica type, while above the line every flower is blasted. At this season of the year, one of the most momentous questions for the gardener is that of the effect of the winter on many of the most prized garden favorites. One can never be sure, until buds are well along, as to what he may expect from his rhododendrons, cornuses, wistarias, early clematises and many other things which because of their precocity are so easily started into activity by a few warm days in early winter, and their flowerbuds, divested of their protecting overcoats, doomed to be ruined later on. The problem of winter and spring effect is full of puzzling contradictions and one year's deductions are quite likely to be overthrown by the experiences of the next year. But one thing is sure—deep snow, long tarrying, is the garden's best winter friend.—*Horticulture.*

Reproduction in Trees.—I read in the February, 1916, number of the *American Botanist* some astonishing statements under the above caption, viz., ' the oak begins to bear when it is between sixty and seventy years old, the ash between forty and fifty." The statements are taken from W. B. Beach in *Tree Talk.* I do not know where the writer is so unfortunate as to have his residence where he can expect to see so little of the "fruit of his labors" in tree planting, but I assure him we do not have to wait any such length of time in fertile Nebraska. There is an English oak (*Quercus pedunculata*) on the campus of the University of Nebraska that bore acorns ten years ago when the tree could not have been over 25 years old. The University was founded in 1869, so that ten years ago it was 35 years old. The tree is very thrifty and has no marks of age except its acorns. The mossy overcup oak (*Q. macrocarpa*) is common over most of Nebraska and bears when it is eight or ten feet high, possibly fifteen to twenty years old. *Quercus acuminata* bears at about the same age, and *Q. prinoides* when three feet high. The white ash of eastern Nebraska and the prairie ash (*Fraxinus campestris*) of all Nebraska make six to ten inches of growth a year and bear when not over ten feet high. Since writing the above, I find a prairie ash not over ten or twelve years old bearing fruit in Hastings in front of the Rectory walk.—*Rev. J. M. Bates, Red Cloud, Nebr.* [We had our suspicions about some of the statements made in the article criticised but, felt sure that if they were open to question our readers would discover them. We are agreeably surprised and pleased to find how carefully this magazine is read by scientists and scholars whose time is valuable. The best part of this matter is that we copied the article in question not from the original source but from a magazine that copied it and the readers of neither magazine took exception to the statements. All of which proves—but why make the other magazines jealous?—Ed.]

Useful Pigweeds.—Apropos of the interesting note in the February number of the *American Botanist* concerning quinoa and other species of *Chenopodium,* I might mention the use by the Pacific Coast Indians of at least two species of the same homely genus. One of these, *C. Californicum* has a root with pronounced saponaceous qualities and on being crushed in water it forms a lather. This was used as a soap and the plant is known as soap-plant by Americans familiar with this characteristic. The seeds of this species, as well as those of *C. Fremonti* (abundant in Oregon), were also used for pinole, being toasted and ground into flour to which water was then added to make an edible mush. Probably under cultivation these plants could be made a valuable source of human food, just as quinoa has been.—*C. F. Saunders.* [In the current number of the *National Geographical Magazine,* O. F. Cook writes that two species of *Chenopodium* are regularly planted for food by the Peruvians and that these are the only seed crops grown in the elevated districts that are too cold for corn. One of these, the real quinoa, grows to a height of three or four feet and is chiefly valued for making beer. Only the white seeded variety is considered edible, the other varieties being very bitter so that they have to be boiled with several changes of water to make them palatable. The white quinoa, according to this writer, makes an excellent breakfast food fairly comparable with oatmeal both as to taste and texture. The second pigweed is called canihua and is used exclusively for food. The seeds are much smaller than those of quinoa and of a grayish color. They are slightly parched and then ground into a fine flour. The chief use of canihua is as a travel ration for the shepherds.—Ed.]

Duration of Life in Rudbeckia.—If you leave it to the books, the black-eyed Susan (*Rudbeckia hirta*) is a biennial; that is, it devotes the first summer of its existence to accumulating sufficient food materials for the formation of flowers and seeds and, after these have been produced, the second summer it dies. But the plants themselves, do not view the matter in this light. They are really perennials. In the editor's garden there are plants of this species that have been there five or six years and show no signs of giving up the struggle. The fact is, that if the *Rudbeckias* are left unprotected during the winter, some of them may fail to resume growth in the spring, but this may happen to any plant if the winter is one of alternating cold and warmth with the consequent heaving of the ground by frost. The plants are not killed by mere cold, however. On the other hand it is not unusual to find in a bed of seedlings many plants that are ready to flower two months from the time they appeared above ground. Possibly all the plants would flower the first year if given an equal start in spring. It is possible, however, that there is both an annual and perennial strain in this species similar to that well known in its relatives the gaillardias, which might be developed by breeding.

Decorative Galiums.—By many lovers of flowers, the species of *Galium* are regarded as insignificant weeds and the opinion can not be challenged if the goose-grass or cleavers

(*Galium aparine*) is selected as the type, but there are a few whose beauty or usefulness lifts them out of this category. The northern bedstraw (*Galium boreale*) is beautiful and decorative enough to be admitted to the flower garden, and indeed is occasionally cultivated, though it manages very well for itself along roadsides and on moist banks where its tiny, though numerous, white flowers form conspicuous patches. A nearly related species (*Galium mollugo*), evidently named for its resemblance to the Indian chickweed (*Mollugo verticillata*), is frequently cultivated. The flowers though exceedingly small are borne in such myriads that its common name of Scotch mist seems fairly descriptive. Beginning about midsummer it blooms for a month or more and is highly valued for adding to bouquets of sweet peas and other flowers whose beauty of form is one of their distinguishing characteristics. It is often called baby's breath, but this name is regarded as belonging by rights to one of the pinkworts—*Gypsophila paniculata*. Our plant is a native of Europe but has escaped from cultivation in various places in the North Atlantic States. The common name of cleavers, applied to members of the *Galium* genus, is equivalent to the term "stickers" applied to other plants whose seeds or stems cling to the clothing of animals or even of man himself.

Food of the Robin.—Just across the street from where this is written, a robin is rearing a family in a lofty elm and feeding it with insects from our garden. Everybody knows in a general way that robins eat earthworms and the larvae of various insects, but it is not until some such opportunity as this brings the matter to one's attention that he realizes how great the number and variety of insects captured, or that the bird has preferences in the matter of diet. As soon as the writer goes into the garden, the mother bird appears and demands food by numerous insistent chirps. She seems to regard digging in the garden as one of Nature's schemes for providing bird food and is so intent on securing this that some care has to be exercised to avoid stepping on her. Early in the season, earthworms were apparently quite acceptible food, but with the advent of young ones, a decided fondness for cutworms, wireworms, white grubs and May-beetles was apparent and the earthworms were neglected. Of the entire list of insects, the white grubs were first in favor. Nothing else could induce the robin to feed from the hand, but the sight of the squirming, fat, white grubs always overcame her caution. The number of harmful insects that a single robin will pick up in an hour is astonishing. Apparently the only representatives of animal life left in our garden are the earthworms. The only point for concern in this, is that there may possibly be nothing left to attract our bird another year, but if this should happen we will import some.

Twisted Stems.—A subscriber on the Pacific Coast writes: "The other day when walking on the Marin County hills near San Francisco a young engineer told me that the ridges in the bark of coniferous trees follow a spiral about the tree always toward the right. He pointed to a Douglas fir to confirm his statement and I could see a very slight tendency for the lines to vary somewhat from the perpendicular toward the right. I had never noticed it and fear I am somewhat skeptical as to its being an invariable custom. Is this known to be a fact, and if so, why? In the high sierras I have seen dead junipers that looked as though they had been twisted all the way around, but thought that this might have been due to the constant winds." At the tip of a growing stem, there is a group of cells which by frequent division add to its length. The new cells formed are at first much smaller than mature cells and increase in size by lengthening and stretching. The lengthening process appears not to occur simultaneously throughout the stem but follows a spiral path, which in most plants might be described as winding upward to the right. Why growth should proceed in this manner is unexplained. Possibly it is a survival from early ancestors in which a single apical cell carries growth upward, as in ferns, where first one cell and then another is cut off from a single apical cell in a never-ending spiral. The leaves of plants, are also arranged on the stem in spirals and twining stems wrap themselves about their supports in a similar way. If a twining stem that has risen above the earth and is feeling about for a support be watched, it will be found to travel round and round in ever-widening circles, and this is also caused by the peculiarities of cell growth already referred to. It is possible, therefore, that the twist in the bark and wood of trees is produced in the same way. In trunks of trees that have been stripped of their bark, such as those used for telegraph and telephone poles, the twist in the wood is sometimes very noticeable.

A Despiser of Gardens.—Probably there is no subject in the whole world that everybody would agree on; even the gentle art of gardening has its critics. One of the world's foremost literary men, noted for his culture and refinement, wrote as follows in reference to gardening. "A garden is an ugly thing. Even when best managed it is an assembly of unfortunate beings, pampered and bloated above their natural size; stewed and heated into diseased growth; corrupted by evil communication into speckled and inharmonious colors; torn from the soil which they loved, and of which they were the spirit and glory, to glare away their term of tormented life among the mixed and incongruous essences of each other, in earth that they know not and in air that is poison to them." Pretty strong, isn't it? And the writer was John Ruskin!

EDITORIAL

A good many years ago, as we reckon time at this office, a botanical society existed in the United States which was unique in consisting of members who had never seen one another, and it was not promoted by institutions for the blind either. The members were possessed of all the faculties vouchsafed ordinary mortals with possibly a few others as distinguishing marks, but residing in widely separated localities, they found it desirable to conduct the affairs of the society by correspondence. The society was divided into geographical sections and each member reported quarterly to his division secretary. The reports, properly arranged, were then circulated from member to member. A better scheme for promoting botanical study could scarcely be imagined. The spirit of co-operation and helpfulness that pervaded the membership made the association of great value to all who had a place in it. Each felt himself charged with the duty of discovering at least one new thing in botany by the time the quarterly reports were due and was stimulated thereby to a deeper interest in the subject. The lasting effects of such an interest has since become apparent, for looking over the old lists of members, beginners and amateurs in those days, one finds more than one name that is now written high on the roll of science. Although a corresponding society with widely scattered members, various opportunities made personal acquaintance possible and the editor counts among his valued experiences several lasting friendships made in this way. We do not know whether the society is in existence or not, but it ought to be. Some of the old members, who continue to read this magazine, will doubtless be able to enlighten us on this point. In some respects the readers of this magazine remind us of this old society. We seldom ask for information on an obscure point without getting a reply, and as for mistakes, we have never yet been able to print a misstatement of fact and get away with it. Even a mis-spelled word will often bring a shower of letters if the correction seems important. We call attention to these things here for the benefit of certain new readers who might otherwise be some time in finding out that one of the best features of this magazine is formed by the short notes which anybody can contribute and which are often suggested by the notes of others. There are altogether too many botanists who think no fact is important unless several pages of type are necessary to elucidate it.

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The world has long been inclined to poke fun at its conception of the botanist who is usually represented as an amiable elderly gentleman equipped with manual, trowel, vasculum, and lens, wandering about the fields, ogling the flowers through a glass, and so intent on his hobby as to be oblivious to all else. The devotees of modern botany, too, absorbed in the study of cells, chromosomes, and unit characters, and forgetting the foundation upon which even their studies are based, are wont to look with some disdain on the mere collector and namer of plants. Time was, however, when he who knew the names of plants was the only person thought worthy to bear the title of botanist, and though the days are forever gone in which the taxonomist was chief, there is still much to be said in favor of the analysis of flowers and the making of an herbarium; of the times when botany was spoken of as "the amiable science" and attracted to its study all intelligent lovers of nature. In these more degenerate days, most of the botanists are made within the walls of college or university. Often they develop without ever seeing plants in their entirety and are brought up on sections and microscopic mounts. Their attempts at naming the species with which they work often amuse the taxonomist who, though dubbed a mere collector, did not arrive at his knowledge of plants without a strenuous apprenticeship in solving the intricacies of his phase of the science, during which his perceptions were sharpened, his judgment quickened, and his powers of deduction strengthened. The individual who knows intimately the flora of his region is entitled to both the respect and admiration of the community. He should be an object of envy were it not in every man's province to do likewise. Botany as a vocation, compared with other phases of science, is an underpaid and profitless pursuit, but botany as an avocation, especially plant collecting and plant naming, is still the amiable science. What other study can so completely take one away from the cares of ordinary life? Every excursion afield is a vacation trip into unknown regions. With one or more like-minded companions, equipped with lunch and collecting case, the botanizer enters a new world from his very doorstep; poking about the hedgerows, exploring strange woodlands and unfamiliar ravines, making voyages of discovery along pond and stream, and everywhere, from meadow to mountain top, making new acquaintances, accumulating unexpected treasures and steadily adding to those impressions which it will always be a joy to recall. And then, when his dwelling is reached at the end of a day's tramp, comfortably tired he sits down with books and specimens and lives over again the day's adventures, verifying his suspicion that some unfamiliar plant is a rarity to be prized, discovering that he has extended the known range of a species, or possibly finding among his specimens new forms or varieties. Small wonder that in the days when all botany was like this, amiable was the only proper term with which to characterize it.

BOOKS AND WRITERS

A new bi-monthly journal, devoted to recording data bearing on heredity, has begun publication at Princeton, N. J. It bears the title of *Genetics* and costs $1.00 a number. Judging from the first issue the contents are likely to prove too technical for any but the advanced student though doubtless exceedingly valuable for reference in all that pertains to its field.

After one has seen a student of the mosses peering through a compound microscope at some all-but-invisible peristome or leaf-cell, he is likely to get the idea that the study of mosses cannot be successfully carried on without the aid of the optician, but such is not exactly the case. In genera containing numerous species that closely resemble one another, a resort to the microscope may be imperative, but it is quite possible to recognize many species without even a simple lens. The reviewer, many years ago, took to collecting mosses, but lacking the patience and the books to properly name them, was kindly helped out of the difficulty by a friend in Concord, New Hampshire. After a specimen was once named, however, he found very little difficulty in recognizing it again when encountered. The mosses have so many peculiarities of growth, habitat, color, and structure as to fairly warrant the claim of "How to Know the Mosses", by Elizabeth Marie Dunham, that it will enable the beginner to name his plants without a lens. The book consists of descriptions of about 80 genera and 150 species of the common mosses in the North-eastern States with illustrations of most of the species described. Two complete keys, based on the leaves and capsules respectively, are given, and several explanatory chapters make clear the few technical matters mentioned in the book. Naming the mosses by the use of this book should be both fascinating and easy. As in other studies, the first few species will be the hardest to name, but by selecting the more characteristic forms, and therefore the most easily identified, first, these will act as guides along the way and make the rest easy. The book contains nearly 300 pages and is published by Houghton Mifflin & Co., Boston at $1.25 net.

"House Plants; Their Care and Culture" by Hugh Findlay is, as its name indicates, a guide to the care of the plants in the house, which begins with several chapters on soils, potting, watering, and the like, and then discusses the needs of the different plants usually grown in houses. As regards the directions given, it may be said that they are practical and to the point, though not always as scientifically accurate as one would expect from a professor in Syracuse University. For instance we suspect that a good many physiological botanists, would scarcely subscribe to the statement on page 45 that "The leaves are the lungs of the plant and if these are clogged by dust the plant catches cold, sickens and dies." In the section devoted to the care of individual species, some account is first given of the group to which the plant belongs and a list of the more valuable varieties for house cultivation are usually given. We note the use of the words Natural Order for what botanists universally call the family, and various scientific names are also mis-spelled, but these faults do not detract from the correctness of the cultural directions given. The book contains more than 300 pages and 125 illustrations. It is published by D. Appleton & Co., New York and costs $1.50 net.

We have received a circular describing six books on fungi which the author asks us to notice in this column. His circular states, however, that he makes no reduction to anybody, dealers included and supplies no copies for examination, from which we infer that any exchange of courtesies we may be inclined to make will be quite like the handle of a jug—all on one side. A dealer who invests his money in advertising and postage designed to make an author's books more widely known certainly deserved some recompense and even magazines cost money to issue. Few dealers are disposed to push a given book for mere love of the writer, but there are a lot of embryo scientists coming along that take this very peculiar view of the matter. Until we are converted, however, we are going to let our author advertise his own books.

In 1897, the late Prof. E. S. Goff, of the University of Wisconsin, issued a little book on "The Principles of Plant Culture" of which seven editions have appeared. Now comes the eighth, revised by Professors J. G. Moore and L. R. Jones of the same university. The title may sound as if the book were designed for the teaching of agriculture, but it has a wider field. It is, indeed, a clear account of the fundamentals upon which all plant growing rests. The agriculturist seldom goes beyond knowing how; the present book will tell him why. Though the related information is arranged in definite chapters, each paragraph is usually a complete account of the phase of the subject treated, so that the book may be read backward or forward or may be begun in the middle. The practical botanist can scarcely open the book anywhere without finding something of interest, and he can feel sure that it is authoritative and up-to-date. All individuals with enough interest in plant life to become good botanists ought to have the book. If he cannot find what he wants in it, we do not know who can tell him. The Macmillan Company, New York, are the publishers. The price is $2.25.

The success of Stevens' "Plant Anatomy" has necessitated a third edition, and this, revised and enlarged, has just appeared from the press of P. Blakiston's Son & Co., Philadelphia. The general excellence of the work is well known, but it may not be amiss to note again that it is arranged on a constructive plan beginning with cells and tracing their modifications through the various tissues of the plant. The activities of the cells, as expressed in such functions as absorption, transpiration, photosynthesis, secretion, excretion, storage, and reproduction, all have chapters devoted to them, after which come chapters on the use of the microscope, reagents and processes, the microchemistry of plant products and the adulterations in foods and drugs. The book is now an octavo of 400 pages with more than 150 illustrations. The price is $2.50 net.

A loose-leaf "Manual of Soil Physics" containing forty-four exercises by P. B. Baker and H. J. Young, of the University of Nebraska, has been issued by Ginn & Co. Following the directions for performing each experiment; there are several questions regarding the results obtained. The authors state that the manual has sufficient material in it for two semesters work, but to the reviewer it would seem as if a class might cover the ground in much less time. The experiments are those usually given in high school classes. Teachers of Agriculture should find them of considerable value. The price of the notebook in the "Biflex" binder is 65 cents.

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WILLARD N. CLUTE, EDITOR

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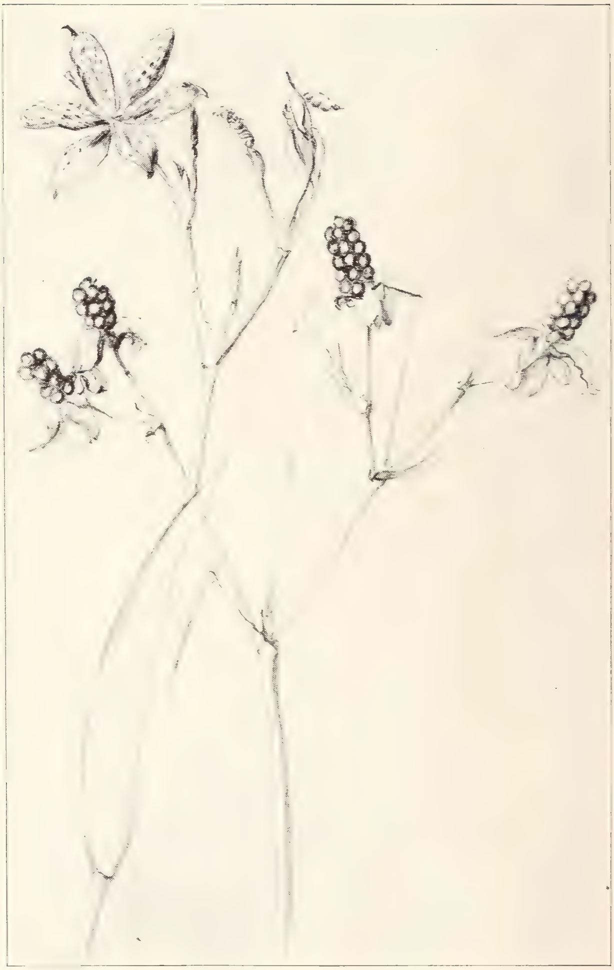


BLACKBERRY LILY.—*Pardanthus Chinensis.*

THE AMERICAN BOTANIST

VOL. XXII JOLIET, ILL., AUGUST, 1916 No. 3

Now from the thyme upon the height,
And from the elder blossoms white,
And pale dog roses in the hedge,
And from the mint plant on the ledge,
In puffs of balm the night air blows
The perfume which the day forgoes.
And on the pure horizon far,
See, pulsing with the first-born star
The liquid sky above the hill.
The evening comes, the field is still.
—Matthew Arnold.

Institution 30 1916 National Museum

THE BLACKBERRY LILY

By Willard N. Clute.

If one desires to see the blackberry lily (*Pardanthus Chinensis*) at its best, it is likely that he will have to visit some old-fashioned garden where new styles in flowers are slow to penetrate. Here in some sunny corner, in company with bleeding hearts, asphodels, foxgloves and other plants dear to our grandmother's hearts, he may find its yellow-green sword-shaped leaves and branching trusses of curiously mottled flowers adding their note to the prevalent air of quaintness. Judged by standards of beauty alone, the blackberry lily must yield to many a denizen of the modern garden, and no longer finds favor in the eyes of cultivators, but undisturbed by this change in public opinion, it has slipped through the fence and struck out for itself like the toad-flax, musk-mallow; tawny day lily, tall cinquefoil and other outcasts from the garden, and may be found here and there colonizing a bit of roadside for itself with a fine show of independence.

In both flower and fruit this plant is so unique that a good many flower lovers still find a place for it in their collections. I know of no other flowers so curiously mottled and barred. The generic name, *Pardanthus,* under which I have chosen to list it, is especially appropriate since it signifies leopord flower. Modern taxonomists, however, insist that the correct name is *Belamcanda*—a term by which it appears to be known in its home land.

Though called a lily, it bears this title by courtesy only. It is really one of the Iridaceae, as its three stamens and inferior ovary indicate. The flowers, however, have more the appearance of lilies than irises, for they spread out in the six pointed stars with which we are familiar in many of the Liliaceae. The three outer segments of the perianth—really the calyx—are distinguished by their slightly paler shade. The ground color of both calyx and corolla is a sort of tawny yellow and this is overlaid with bars, dots, and splashes of dull purplish red. The flowers last but a single day, opening rather late in the morning and closing about sunset, the perianth rolling up on the top of the ovary in a tight little twist. New flowers continue to open, however, and the blooming season lasts for many weeks.

Shortly after flowering, the seed pods become noticeable. At first they are triangular green objects like ordinary iris ovaries, but as the season progresses the outer husk splits down into pale gray papery valves exposing the shining black seeds attached to a stout axis, the whole very closely resembling a ripe blackberry. The seeds are covered with a thin pulp—really an aril like those of bittersweet and pomegranate—and the whole structure almost entitles us to call it a berry.

It really is as much of a berry, as the blackberry and raspberry, for botanically, even these are not berries.

In growth, the blackberry lily is so much like an iris that for all purposes of cultivation it may be treated as if it were an iris. It multiplies vegetatively by means of a branching rootstock, but the seeds germinate readily and young plants reach blooming size about the second year. When once established, it seems to require little care, but it is all the better for a mulch of leaves or straw during the winter, especially in the more northern parts of the country. Though never so conspicuous as its relatives, the gladiolus and iris, it nevertheless deserves sanctuary in the garden and will repay such kindness by thriving in any odd corner.

AN IDEAL SERIES FOR THALLOPHYTE-BRYOPHYTE STUDY

By R. I. Raymond.

T IS the writer's conviction, after some eleven years of teaching Freshmen classes in Botany and Biology, that the commonly suggested type-series of Thallophytes and Bryophytes, as found in most text-books and laboratory manuals, is not as desirable an introduction to these plant phyla as may easily be produced, and this too whether the series be looked at as an introduction to phylogenetic conceptions, or as picturing physiologic-morphologic advances, or as simply typifying the great groups in certain select representatives.

One cannot escape the conviction, moreover, that the usual types are chosen, in almost stereotyped fashion as texts come and go, for the very poor reason that they are easily procurable —as if that might be taken as a good reason for inclusion or exclusion of this or that organism. But the days of "Cladophora" as an algal specimen, and "Marchantia" as an all-sufficient exemplification of a liverwort are gone, we trust forever; and the large variety of genera and species offered by the biological supply houses today renders a defense of the haphazard choice of illustrative types both futile and needless.

To be specific: we desire to have specimens that will (1) adequately represent the groups, without undue specialization, —"central types"; (2) offer a progressive sequence in physiology and morphology without sacrifice of natural relationships; and (3) picture the main lines and data of phylogenetic history, and do this without implying precarious genealogical hypotheses.

Now it is just this list of desiderata that the "orthodox" types, as we might almost dub them, fail to satisfy. To begin with, we wish an exceedingly primitive, isolate, holophytic cell with which to commence the Thallophytes (I include here the Protophytes), and what do we find proposed? *Pleurococcus,*—or worse, *Oscillatoria*. The first is already triply specialized beyond the imperatively simple structure of a primordial type; for it possesses a nucleus, chromoplasts, and a cellulose wall; and the second is an even more fraudulent substitute for the thallophytic "precurseur", it is even filamentous!

Again, take the Chlorophyceae: why pick the bizarre *Sphaerella* as a type in place of the ideally unspecialized *Chlamydomonas?* And why on earth suggest even *Pandorina* or *Volvox?* Can we get "to anywhere" in botany by following the morula-blastula road so clearly indicated in these organisms? And why present the Zygophycean cul-de-sac to the bewilderment of the neophyte? Such groups lead to nothing and profit the student not one idea, except a trifle of curious data in algology. What is the use, moreover, of introducing the unusual and never-to-be-met-with-again problem of coenocytism in *Vaucheria*—*unless* it is at once followed up by the treatment of the

Phycomycete problem? And among the Phaeophyceae, it is almost perverse to select *Fucus,* when *Ectocarpus* and *Laminaria* might be chosen and would present in simplest and vivid form the double problem of phaeophycean derivation and evolution toward the thalloid type.

When we get to the Bryophytes things are somewhat better, but the Fungi leave us with the uncomfortable feeling of having witnessed a waxwork show. It really is not incumbent upon a botanical text writer to fish up every devious bit of morphology and reproduction in his mycological treasure-house; he might do vastly better to simplify his material and order it in some fashion other than mere taxonomy suggests. And are we all so afraid of our smugly cherished "authority" that we cannot suggest to the student where likelihood of relationship lies? Can we not at least follow the results of latest authoritative research, and give the tyro the comfort of that? No line of fungi dropped down from heaven or instituted itself by any *geratio aequivoca.* Every one of these groups has an origin in holophytic ancestry, and where the connection is even partially evident, it should be put before the student, however tentatively one feels it need be done. The German texts are away ahead of us in this respect; there is no timidity in their handling of morphologic problems or of phylogeny. But of the fungi and their typic exemplification more anon.

In the Bryophytes there still lingers the *Marchantia* tradition that will continue to claim an absurdly disproportionate amount of space in comparison with the importance of the curious group. But, (I cannot avoid the feeling of debt here to Campbell's archegoniate studies), the truly representative genera, such as *Pellia, Ricciocarpus, Anthoceros,* are being given their due. One gets the impression that the mosses are still "lumped", for there is little attempt made to get them into relation with the liverworts or to indicate their own progress;

but after all that is a minor matter, for the mosses are unimportant little beings, however interesting for their own *beaux veux,* and the treatment of the unimportant is not of such great consequence.

But the whole matter is different with the other groups mentioned. They do lay foundations—*all* the foundations of later plant history—and we have no right to pick at random the specimens that go into the picturing of those profoundly significant evolvings of primordial plant life.

I have sketched out in the following what I have grown to consider an ideal series, from the standpoint of the considerations referred to above. Naturally, substitutions in it may be suggested, but in most cases, any substitution would lose some one or more of the desirable points presented in the "ideal" type enumerated.

For the institution of plant study I select one of the nitrifying organisms, a non-chlorophyllous, non-flagellated organism, without nucleus, and with homogeneous (non-alveolar) protoplasm—the simplest holophyte conceivable. In such a form there is no stumbling-block for the student in the way of already present specializations. At the same time, it furnishes an ideally simple morphology in which the whole series of assimilation-reactions is accomplished: the synthesis of carbohydrates, of amino-acids, of proteins; and together with these the universally present respiratory, growth, and reproductive functions. To have these fundaments worked out in such an elementary exemplar simplifies their comprehension tremendously—that much as concession to good pedagogy; and incidentally, this choice of example is vouched for by the best of authorities, Nature herself, inasmuch as without question such organisms were the earliest types.

From the nitrifying bacteria (non-flagellated) the way to an understanding of the Chroöcoccaceae and Oscillatoriaceae is easy; for the alveolation of the cell-protoplasm with consequent increase in cell-volume, the primitive chromoplasts, and the primitive nucleus are simple steps to make; and the varieties of colonial (filament) organization offer no difficulties of interpretation.

Again, one of the *flagellated* nitrifying bacteria (*Nitromonas*) serves best as an introduction to the flagellate type of cell; for in the first place, there is hardly question but that flagellation historically preceded the other specializations of the Chlorophyceae, and, in the second place, such a simple type presents only the one new characteristic upon which we wish to concentrate attention. All the problems connected with locomotion may be treated here elementarily, yet satisfactorily.

Chlamydomonas is a next selection as exemplifying the origin of the great Chlorophycean group. Here the discussion of the alveolation of protoplasm, the specialization of the henceforth indispensable auxiliary, chlorophyll, and the significance of the nucleus and its phenomena, may all be taken up. Indeed, it seems to me most urgently advisable (and class-room experience justifies the conclusion) to thrash out each problem *in the earliest type in which it appears,* rather than wait till we reach the complex types. *Chlamydomonas,* moreover, serves as an ideal introduction to the sex-problem in plants, and the evolution of the pure isogamy found here will warrant considerable space of lecture-energy.

For a type in which the advent of the walled, non-motile stage is indicated—yet in simpler form than the fillament-organization—*Tetraspora,* will serve. The significance of the cellulose restraint upon all later plant life is to be stressed here.

Ulothrix is always an admirable introduction to the filaments—and to the fourfold zygote division that apparently instituted the later sporocarp and sporophyte. *Stigeoclonium,* in other respects like *Ulothrix,* exemplifies the origin of the branching filament. *Aphanochaete* (I admit a not very common genus) presents an ideal alga for the exemplification of gamete-differentiation, together with the tendency toward concrescence of branches that eventually leads to the thalloid types. The decided advantage of this genus in the presentation of gamete-differentiation lies in the fact of its obvious and immediate relationship with the preceding types and the succeeding. Citations of *Cutleria* or *Pandorina* and *Volvox* are quite beside the mark when such a satisfactory genus as *Aphanochaete* is available for the demonstration. *Coleochaete soluta* serves as an excellent type for presenting the final differentiation of the sex-cells and for the significant increase in size of the fertilization-product, the sporocarp. *C. scutata* pictures the transition of body-form from a concrescent filamentous structure to a leaf-like thallus.

Right in this connection the problem of fungal origins is to be best taken up—as far as the Phycomycetes are concerned; and it is well, pedagogically speaking, to utilize such vivid transitional cases for the stimulus they offer to the student in the direction of homologies and data of phylogenetic significance. Bessey's consistent and courageous treatment of the alga-like fungi in close (in fact immediate) relation with their progenitors should have a more hearty assent, it seems to me, than we have given it. And there is little difficulty in introducing the types through an ideal series. First the problem of coenocytism is to be worked out in the algal ancestry; and for this *Cladophora* and *Vaucheria* serve excellently. In the latter, the second problem, that of saprophytism, is raised and its solution indicated in the occurrence of the "rhizoids". *Saprolegnia* next, with its incipient degeneration of the sexual process, introduces the fungal types proper (the student might well be referred here to the Phyllosiphonaceae). *Albugo* and *Rhizopus,* illustrate the further adaptation to aerial life and the ultimate degeneration of gamete-differentiation.

In passing on to consider the brown algae it may be suggested that the laboratory study of but two types is sufficient for such an isolated group. As mentioned above, *Ectocarpus* and *Cutleria* are preferable to *Fucus,* inasmuch as in the first, we have simple filamentous body-structure passing into thalloid, and in the second thalloid, purely with very instructive differentiation of gametes; while the third type involves at once the complex thallus structure along with fully differentiated reproductive organs.

The red algae may conveniently be treated by examination of the usual laboratory types, *Nemalion* and *Polysiphonia.* Perhaps one need not be too chary of finding homologies with the Coleochaetaceae, and of instancing the parasitic species in preparation for later study of the Ascomycetes. It may be well to remind authors here that the institution of the sporophyte generation is something that took place in time; that the reduction divisions in the chromosomes that separate gametophyte from sporophyte generations are simply an immediate occurence in *Coleochaete* (and lower algae), a later incident of life-history in the Rhodophyceae; and that therefore the "chasm" between Chlorophyceae and Rhodophyceae is merely one of arbitrary assumption.

The Ascomycetes are best treated in immediate connection with the red algae, for obvious reasons, and the homologies deserve much more than the casual mention they usually receive. An aquatic type should certainly be utilized to begin with, and the lichenous form *Collema* is advisable as easily available. The closest of homologies between this species and Rhodophycean types may be traced, as regards the whole reproductive process and organ-complex. The gradual ecologic shifts in habitat (aquatic to terrestrial) and nutritive method (symbiotic to parasitic) may be indicated for the group by following up *Collema Sphaerotheca* and with *Pyronema.* Only after consideration of such two types should the complex apothecium-producing forms be taken up.

In investigating the Basidiomycetes the beginner is best aided by starting with *Ustilago*—*not* the Hymenomcytes, as having too highly developed a sporophore, and *not* the Uredinales, since their study involves the puzzling succession of spores. After *Ustilago, Exobasidium* and *Clavaria* may be taken to illustrate the establishment of true basidium-structure and the origin of the fleshy sporophore. *Hydnum* and *Agaricus,* finally, indicate the appearance of the pileus form of spore-bearing and the development of the characteristic gill-hymenium. The Gasteromycetes might well be left out of an elementry course.

As we enter the Bryophyta, we need indications of the derivation of amphibious from aquatic habitat. For this *Ricciocarpus* serves well, but we should be careful to make much of the land-thallus *physiology*—a subject almost neglected save in the matter of reproduction. *Notothylas* should be intercalated between the type just mentioned and *Anthoceros,* because of its intermediate complexity in sporotype structure; the leap from the spherical to the large columnar body being a real difficulty to the student. The *Marchantia* and *Jungermannia* forms may be passed over with little consideration, as with the Gasteromycetes.

For the mosses it should be said that the series cannot be easily presented unless *Sphagnum* (*not* a "common moss") be taken first—this of course on account of its gametophyte structure as well as that of the sporophyte. A single true moss suffices for the Bryales,—it should *not* be the peculiarly complex *Polytrichum*.

In the above choice of specimens for first-year work in the field indicated there will be found an avoidance of the specialized types that are so bristling with difficulties for the novice, and on the other hand there will be found a series of forms, full of suggestiveness to the young comparative morphologist, and one serving at once to vitalize comparative physiology and give broad ground for evolutionary thought and taxonomic enthusiasm.

BOTANIZING IN THE CORPUS CHRISTI REGION

By R. A. Sell.

ORPUS CHRISTI BAY, being shut off from the Gulf of Mexico by a chain of narrow sand spits with only a few passes connecting, is one of the most attractive resorts in the world. Shallow salt water, tempered ocean breezes and the absence of an undertow combined with fishing grounds where an amateur can fish with some degree of success, are features that have been advertised quite extensively, but the plant life which is both varied and distinctive has received comparatively little attention.

As the bay is, in reality, a remnant of a larger body of water much of the adjacent land is composed of sand, shells and other beach deposits. Throughout a very large territory a sheet of salt water can be found about on a level with the surface of the bay. Fresh water cannot be had from wells and while plants grow well during wet weather a period of drouth is very destructive. As the Nueces river empties into the bay it is said to be only semi-salt, but because of extra evaporation it is practically ocean water. The Nueces, being a very slow-running stream, brings a great volume of such forms of sediment as can be held in solution, and as the water for several miles above the mouth is even more quiet than that of the bay, this sediment slowly settles and forms a thick black ooze that can be readily raised to the higher ground by high water. This rich black soil supports a luxuriant growth of trees, tangled vines and weeds. The vegetation of the area fertilized by the river is typical of the Gulf Coast country and sets off in sharp lines a contrast most striking. The high ground—the land outside of the old lake basin—is covered with grease-wood, Spanish bayonets, chaparral, and various forms of cactus.

We were located in a cottage built on a pier over the bay, and for a place in which to put away dull care and make faces at a Texas summer, it would be hard to duplicate. In the morning take a vasculum and ramble wherever something of special interest appears, collect some of the rare specimens, and after putting them to press, take a swim. Late in the evening, a trip would be especially enjoyable among the halophytes that were so plentiful just above high water line. Many kinds of sea-weeds are washed in by the waves and a small bunch is usually swarming with various forms of animal life—miniature crabs, lobsters, shrimp, clams and sponges. Some of these marine plants are very beautiful in form as well as color and texture. There are algae of various shades of red and blue and green, but a very common brown variety forms a rich sepia that blends with the more striking colors to make an artistic border. The long kelps are mostly under water so that when the bay is calm they appear as a submerged field of cultivated plants.

Possibly the salt cedar is the most striking tree. Calm, dignified, and aristocratic, it appears as a patriarch of all the trees and shrubs of the locality. Its gnarled trunk draped with a graceful fringe of delicately shaded green, the friendly trailing branches festoon a canopy just thick enough to make the shade complete without interfering with the circulation of the air. The sublime dignity and poetry of the surroundings add a rare zest to a lunch in the salt cedar gardens. Of the other cultivated plants that might be mentioned, the elite oleanders—red, white, scarlet and yellow—which grow so abundantly and give color to the landscape. Then there are the palms—tall spires with large umbrellas formed of spreading fans or gracefully bending feathers.

The sea ox-eye (*Borrichia frutescens*) which grows along the margin of the bay is very interesting because it defies the hot sun and raises its head even when the beach is like molten brass. An excellent instance of adaptation is this low fleshy-leaved halophyte. Occasionally a bunch of alkali grass (*Distichlis maritima*) may form a hiding place for the little swift lizards while sea oats (*Uniola paniculata*) grows with less pretense but with a persistance that meets the conditions. Farther back the scalp lock (*Euthammia graminifolia*) flaunts its cylindric heads. In order that they may not be without all the symbols around which are grouped some beautiful and playful superstitions, the matrimony vine (*Lycium*) has a representative that compares favorably to some of the forms that have been so carefully cultivated for more than a century.

In the vast areas which might appropriately be termed the median shelves of the ancient salt water basin, it seems that every plant has spines. Here may be found various forms of prickley pear, Indian fig, pin cushion, Mexican beads, lady fingers and medicine bottles, besides dwarfed yuccas, sword cactus and many other cacti, but the thorny chaparral, cats' claws, mesquite and huisache are silent emblems of the principle of preparedness. Possibly the most formidable of the shrub-like cactus is the thorn bud (*Opuntia leptocaulis*) whose varying forms and lengths of sharp brittle spines stand like a phalanx against intruders, large or small. The little Mexican beads (*Mimosa pallida*) displays varying shades of green that are always restful to the eyes, and a vast hoard of little butterflies such as the lyside (*Kricongonia lyside*), the phaon (*Phycodes phaon*) and the southern snout butterfly (*Libythea carinenta*) are continually darting among them with a calm disregard for the thorns. The fruit of the Mexican beads are gathered by the Mexican children and strung on threads.

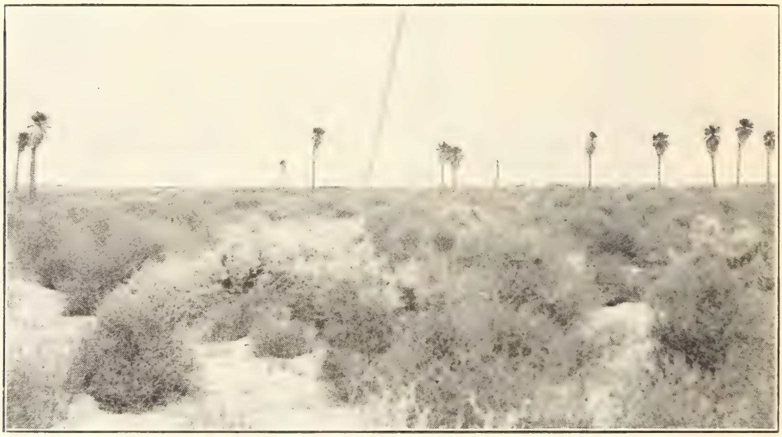
A large field of these low growing semi-desert plants is by no means an unpleasant sight. There are varying shades of green, from extremely light to extra dark, that blend admirably when surveyed from a distance so as to form something of a cloud effect. Just enough life in the form of birds, butterflies, and dragon flies is in evidence to form a fringe and break the set background of a rather quiet landscape. No artist could paint the delicate shades and tints as they merge into a deep blue sky or a long stretch of dusty road.

WEIGHT OF OUR NATIVE WOODS

IN ATTEMPTING to estimate the weight of a piece of wood, we are often deceived by its appearance. In general hardness is associated with weight, but this is not always a safe guide. Though the wood itself may be hard, the presence of numerous large ducts, through which the water travelled when the tree was alive, may have a considerable effect in lessening the weight of the specimen. It is stated that the weight of pure wood fiber is the same for all kinds of wood, but the pore space and the amount of moisture the wood contains accounts for the difference between various species. In a bulletin on the "Qualities and Uses of the Woods of Ohio" Professor William Lazenby gives a list of their weights newly determined whch we reproduce here through the courtesy of the Ohio Biological Survey. It is likely that the list contains some surprises for those who do not come much into contact with plants after they are worked up into lumber. One might expect, for instance, that the black walnut would be heavier than the elm and would scarcely regard the locust as heavier than either. The woods in the list are arranged in the order of their weight. The specific gravity given is only another way of stating the weight since it indicates how much a given specimen weighs in comparison with an equal bulk of water. Anything with a specific gravity less than 1.00 will of course, float on water. None of our woods are heavy enough to sink in water, but several tropical species are said to do so.

	Weight cu. ft.	Specific Gravity.
Arbor Vitae (*Thuja occidentalis*)	22.28	.324
Catalpa (*Catalpa speciosa*)	21.72	.347
Balsam Poplar (*Populus balsamifera*)	21.99	.352
Black Willow (*Salix nigra*)	22.86	.366
Ohio Buckeye (*Aesculus glabra*)	23.43	.375
Hemlock (*Tsuga Canadensis*)	23.77	.380
Basswood (*Tilia Americana*)	24.00	.384
White Pine (*Pinus strobus*)	24.02	.385
Box Elder (*Acer negundo*)	25.15	.402
Cucumber tree (*Magnolia acuminata*)	26.63	.416
Red Mulberry (*Morus rubra*)	26.57	.425
Butternut (*Juglans cinerea*)	26.57	.425
Large-toothed Aspen (*Populus grandidentata*)	26.57	.425
Cottonwood (*Populus deltoides*)	27.15	.433
Chestnut (*Castanea dentata*)	28.28	.452
Red Cedar (*Juniperus Virginiana*)	28.28	.452
Red Elm (*Ulmus fulva*)	30.86	.494
Sassafras (*Sassafras variifolium*)	31.13	.498
Buttonwood (*Platanus occidentalis*)	31.13	.498
Black Ash (*Fraxinus nigra*)	32.27	.516
Black Walnut (*Juglans nigra*)	32.92	.527
Tulip Tree (*Liriodendron tulipifera*)	32.96	.528
Sweet Gum (*Liquidambar styraciflua*)	33.76	.540
Blue Ash (*Fraxinus quadrangulata*)	34.00	.544
Jersey Pine (*Pinus Virginiana*)	34.29	.549
Red Maple (*Acer rubrum*)	35.36	.566
Black Cherry (*Prunus Virginiana*)	35.82	.573
Pitch Pine (*Pinus rigida*)	35.82	.573
Tamarack (*Larix laricina*)	35.82	.573
Red Oak (*Quercus rubra*)	35.93	.575
Yellow Birch (*Betula lutea*)	37.72	.608
Shingle Oak (*Quercus imbricaria*)	38.00	.609
White Elm (*Ulmus Americana*)	38.65	.619
Hackberry (*Celtis occidentalis*)	38.65	.619
Blue Beech (*Carpinus Caroliniana*)	38.65	.619
Silver Maple (*Acer saccharinum*)	38.86	.622
Yellow Locust (*Robinia pseudoacacia*)	40.00	.640
Scarlet Oak (*Quercus coccinea*)	40.00	.640
Sugar Maple (*Acer saccharum*)	41.14	.658
Black Oak (*Quercus nigra*)	42.06	.673
Honey Locust (*Gleditschia triacanthus*)	42.69	.683
Coffee Tree (*Gymnocladus dioica*)	42.91	.687
Swamp White Oak (*Quercus bicolor*)	43.43	.695
Bitternut (*Hicoria cordiformis*)	44.39	.710
Beech (*Fagus grandifolia*)	44.39	.710
Pepperidge (*Nyssa sylvatica*)	44.50	712

	Weight cu. ft.	Specific Gravity.
White Ash (*Fraxinus Americana*)	44.50	.712
White Oak (*Quercus alba*)	44.85	.718
Chestnut Oak (*Quercus prinus*)	44.86	.718
Burr Oak (*Quercus macrocarpa*)	46.29	.741
Sweet Birch (*Betula lenta*)	46.57	.745
Persimmon (*Diospyrus Virginiana*)	46.58	.746
Ironwood (*Ostrya Virginiana*)	46.92	.751
Juneberry (*Amenanchier Canadensis*)	47.48	.760
Wild Crab (*Malus coronaria*)	47.66	.763
Mockernut (*Hicoria alba*)	48.73	.780
Shagbark Hickory (*Hickoria ovata*)	49.14	.787
Pignut (*Hicoria glabra*)	51.56	.825
Yellow Oak (*Quercus acuminata*)	55.72	.892



THE TWELVE APOSTLES OF THE COLORADO DESERT

AMONG the natural curiosities of our Southwest is an isolated group of twelve California Fan Palms growing in the open Colorado Desert of southeastern California, and shown in the accompanying photograph. They are locally known as "The Twelve Apostles," the appropriateness of which title is at once acknowledged by the traveler when he notices that one of the trees is blasted and its head entirely gone—the obvious Judas of the band.—*C. F. Saunders.*

THE WILD FLOWERS OF HAWAII

By Vaughan MacCaughey.

THERE seems to exist among people who are but slightly familiar with the tropics, and whose knowledge of equatorial regions is based largely upon casual reading and hearsay, a deep-rooted and widely spread misimpression concerning the floral marvels of the tropic jungles. Certain writers of a florid disposition, like the gardeners in northern conservatories, have packed within the narrow confines of a single description the gorgeous and spectacular floral wonders of a score of widely-separated regions. The riot of unfamiliar colors, the strange eccentricities of form and habitat, the weird gloom of the jungle, starred with fantastic bouquets—these have been compressed by facile imagination into restricted areas, whereas in fact they are far-scattered, and isolated by great stretches of relatively barren and insignificant vegetation.

One's first actual excursion through a tropic forest is customarily an experience of severe disillusion and readjustment of perspective. The somber hue of the heavy foliage is oppressive. The forest canopy, high above one, is remote and gloomy. The trunks and branches are strangled by tortuous lianas and smothered under a dripping envelope of epiphytes The soggy floor is densely covered with rapidly decaying vegetation; there is no familiar crisp leafy carpet, and there is a notable absence of bright flowers. Those plants that survive in the dense perennial shade are rich in varied greenery, but scant of blossom. In many places the ferns form a high, dense undergrowth, that is penetrated with difficulty. During much of the year everything is water-soaked. The vegetation is engaged in a life-or-death struggle for head-room and sunshine; there is none of the sunny serenity of an eastern woodland. In the clearings the lianas and under-brush snarl into inextricable tangles. Frequently the trail must be carved out with machetes. The forest seems barren of blossom.

After a few trips, however, one's eyes become accustomed to the diversified greenery and the humid shade. A mental re-alignment takes place, almost unawares, which puts this sombe̍r background into the subjective background. Here and there the brilliant blooms appear. Rarely profuse in any one place, usually sequestered by the enmassing foliage, nevertheless, the presence of these tropic flowers•gradually grows upon the consciousness, and one becomes aware of their charm and beauty. They become familiar, anticipated, and the long flowerless stretches are forgotten in the joy of seeing again a glowing mass of color against the luxuriant verdure of the woodlands that are forever green.

This paper is a rapid enumeration of the beautiful wild flowers that adorn the beaches, lowlands, valleys, and mountains of the Hawaiian Islands. It is based upon eight years of residence and field work in that beautiful island world of the mid-Pacific. Only those fairly abundant forms with showy or striking floral effects are included. Many of the rarer and smaller flowers possess beauty excelling that of the conspicuous ones, but of a finer and more subtle quality.

The most conspicuous and abundant flower in the Hawaiin forests is the *lehua* (*Metrosideros polymorpha*). This tree is the commonest of the native species, and grows at all elevations, from arid lava coasts, far up onto the rainy valley slopes and mountain ridges. As its specific name indicates, it varies greatly in stature and habit, from a stately tree of 125 feet, to a prostrate shrub scarcely lifting its head above the swamp grasses. The flower is an impressionistic cluster of deep scarlet, stamens, an inch or more in length, and much longer than the inconspicuous petals and calyx. These beautiful pompons are arranged in terminal corymbs, and stand out showily beyond the small, close-set leaves. As the flowering season is practically continuous, any view from ridge or peak across the treetops is sure to disclose a generous sprinkling of the rich red blossoms, shining like birds against the gray-green background of the *lehua* foliage. Because of its abundant nectar, the *lehua* flower attracts great numbers of the native insects and birds, and is an important element in the food supply of these creatures. Many of the highly specialized Hawaiian birds known as "honey-suckers" are confined largely to the *lehua* forests.

In the humid valley floors and ravines of the lower forest zone are extensive groves of a handsome tree widely known and prized in the Pacific and Malayan regions. This is the *ohia ai* (*Eugenia Malaccensis*) known as "mountain apple" in English, because of the crimson, palatable, apple-like fruit. The flowers occur not only at the ends of the branches, but also on short spurs along the trunk and larger branches. Like its relative, the *lehua*, the flower is a delicate cluster of long, spreading, bright red stamens, that contrast charmingly with the glossy, rich green foliage. During the flowering season, in early summer, the shady interior of the tree seems to be filled with a delicate scarlet haze.

The *nohu* (*Tribulus cistoides*) is a common lowland flower, that also occurs on most of the low coral isles and atolls of the North Pacific. It is an herbaceous perennial mat-plant, with trailing hairy branches, and pinnate leaves. The light yellow flowers, axillary and solitary, are about two inches in diameter. They are conspicuous in the early morning, like sunbeams scattered on the greenery, but wither in the glare of the day. The fruit is armed with stiff spines, and woe to the barefooted native boy who inadvertently treads upon it.

A brilliant sea-shore shrub is the *ohai* (*Sesbania tomentosa*). This is a much-branching legume, six to twelve feet high; the leaves have eight to eighteen pairs of pinnae, and the large scarlet flowers are in loose axillary racemes. The natives are fond of the bright flowers, and the bush is often to be found in the vicinity of the little beach settlements, particularly along the arid leeward shores, where vegetation is scanty.

Another littoral plant beloved by the natives is the *kou* (*Cordia subcordata*). This tree was brought by them from their South Sea home, in the days of the long migrations. At one time it was abundant along the shores, but is now quite rare. The ancient name for the site of Honolulu was Kou, and referred to a famous grove near the shore. The broad, leafy crown cast a grateful shade on the hot beach, and the large orange flowers were plucked and strung in garlands. The flowers are campanulate, with a long corolla tube and a broadly expanded limb, five- to seven-lobed. The Hawaiians also prized the soft, durable wood for their carved bowls and dishes, as it took a beautiful polish, and exhibited a handsome wavy pattern of varied shades of brown.

The Pride of India tree (*Melia Azedarach*) is not indigenous to Hawaii, but was introduced many years ago, and is now thoroughly naturalized on the lowlands and in the valleys. It is one of our few deciduous trees. The abundant clusters of delicate lilac-blue flowers appear with the tender new leaves, and cover the bare frame-work of branches with a lovely diaphanous drapery of delicate lilac and green. This handsome tree is common along the roadways, and in the neighborhood of the native settlements.

Another deciduous tree of the lowlands, with showy flowers, is the *wili-wili* (*Erythrina monosperma*). This is a leguminous xerophyte, with squat gnarled crown and short stocky trunk. The sparse foliage is three-foliate, and is shed in late summer. After the rains the flowers appear, preceding the new leaves. The flowers are pale scarlet or orange, occasionally creamy yellow, and are clustered in axillary racemes. The standard of the flowers is one and one-half to two inches long and nearly as broad, and is quite showy. The Hawaiians had an old proverb which prohibited sea-bathing by the children while the *wili-wili* is in flower, for at that season the shark was supposed to be particularly aggressive.

Immortalized in Hawiian song and legend are the bright yellow flowers of the *ilima*. Of these were made the choice *leis* or garlands for which the native had a passionate fondness. The *leis* of twisted orange-yellow crepe-paper which the native women sell at the wharves on "steamer day," and which tourists bring back to the mainland as mementos of their happy visit, are meager imitations of the glowing *"lei ilima"* itself. The flowers are gathered from a low shrub *Sida fallax*. There are a number of other closely related species which also have rich yellow blossoms, belonging to the Mallow family. The *ilima* is abundant on the dry lowlands, and adorns the dreary lava flows and wastelands with its cheerful bloom. The plant itself is three or four feet high, and shows its xerophytic character by its covering of dense white velvety tomentum. It flowers continuously, and constitutes one of the few showy elements in the somewhat scanty lowland flora.

Here and there on the semi-arid lowlands, on the hot coral plains and lava fields, and along the sandy shores, occurs a low straggling shrub with large fragrant flowers. The white petals are two inches long, and the cup which they form is filled with beautiful delicate white stamens, about three inches long, and projecting well beyond the petals. This is the *maia-pilo* (*Capparis Sandwichiana*). The flowers are solitary in the axils of the round, entire, pale green leaves. The straggling habit of the plant itself is not particularly attractive, but the delicate flowers, opening in the cool of the day, are as graceful as aigrettes.

Two very abundant flowering shrubs of the drier lowlands and valleys are the *klu* (*Acacia Farnensiana*) and the *koa-lei* (*Leucaena glauca*). Both were introduced many years ago, and are now thoroughly naturalized. The spiny *klu* has globular heads of tiny, fragrant, rich yellow flowers. The floral heads of the *koa-lei* are larger—an inch in diameter—and white. These mimosaceous plants frequently become tall shrubs or small trees, and are continuously and profusely laden with bloom. The *klu* has formed extensive thickets or chaparral on the Oahu lowlands, and is also abundant as an undershrub in the valuable *kiawe,* or mesquite (*Prosopis juliflora*) groves.

A low shrub, also of the Legume family, that enlivens with its masses of yellow flowers the barren lower slopes and open places in the drier woodlands is the *he-uhi-uhi,* (*Cassia Gaudichaudii*). The flowers are clustered in axillary racemes, and are plentiful after the winter rains. The individual flower is not especially conspicuous, but the mass effect is noteworthy.

A number of representatives of the Convolvulus family are common, and possess showy "morning-glory" flowers. The *pili-kai* (*Argyreia Tiliaefolia*) is a stout woodly liana, occurring here and there on the lowlands and valley floors. The pale purple flowers are 2½ inches long, and abundant among the large heart-shaped leaves. The *po-hue-hue* (*Ipomoea pes-caprae*) is characteristic of Hawaii's coral beaches, like those of many other tropical strands. Its prostrate creeping stems often attain a length of thirty or forty feet, with large, glossy, succulent two-lobed leaves, and purplish-pink flowers two inches long. *Ipomoea bona-nox,* native of India, climbs over our lowland vegetation, and forms great masses of foliage. The white flowers are very showy, with a long slender corolla-tube of three to four inches, and a spreading limb of three to four inches in diameter. The blossoms open in the cool of the afternoon, and remain open throughout the night, wilting under the morning sun. *Ipomoea tuberculata,* the *koali,* is another vigorous twiner, common in low and dry rocky places. The flowers are delicate purple red, two inches long. Another *koali, Ipomoea insularis,* is very common in the lower woodlands, where it envelopes the shrubbery and smaller trees with its dense entangling masses of foliage. The fragile azure-blue flowers are two to three inches long.

The *mauna-loa* (*Dioclea violacea*) is a tall, woody leguminous liana. It climbs up the coco-palms along the beaches, and festoons shady groves in the lowland gulches. The leaves are three-foliate; the flowers are clustered at the ends of stiff peduncles, twelve to fifteen inches long. The bold flowers are deep blue or violet. *Canavalia galeata,* the *awiki-wiki* of the natives, is a noteworthy leguminous liana, and often climbs to great height. The pink or purple flowers are borne in clusters at the ends of axillary peduncles four to eight inches long, and are of distinct beauty. This vine occurs both on the lowlands and in the lower forest zone, up to two thousand feet elevation.

An introduced leguminous vine, *Mucuna urens,* the "cow-itch" of South America, is found on the uplands of Maui and Hawaii. The young shoots and the pods of this tall climber are clad with silky, stinging hairs. The leaf is three-foliate, and very waxy underneath. The long axillary peduncles bear fascicles of ten to fifteen flowers; the flowers are large, two inches long, and a lively bright yellow, with some red.

A strong vigorous liana, the leguminous *Vicia Menziesii,* is a characteristic high mountain form, as it is limited in range to the upper margins of the extensive forests on Mauna Kea and Mauna Loa, Hawaii, at an elevation of seven thousand to eight thousand feet. The vines are very leafy, the leaves are six to seven inches long, with eight to twelve leaflets, and terminating in a compound tendril. The axillary inflorescences each comprise six to eight large pale purple flowers, one to two inches broad. The vine climbs to a height of twenty to thirty feet, and drapes the forest with its luxuriant foliage and bouquets of flowers.

A brilliant flower of the dense woodlands is the scarlet *ka-iwi* (*Strongylodon lucidum*). This is a high-climbing woody leguminous liana, with herbaceous branches. It adorns the tree trunks in the shady forest with its graceful foliage, shot here and there with the pendant flaming racemes, which are ten to eighteen inches long. The flowers are like those of the bean or pea in form, with a showy reflexed standard, and a long scimiter-shaped keel. This last peculiarity has given the native name *nuku-iwi,* which compares the keel with the long curved beak of a Hawaiian red bird. The leaves of the *ka-iwi* are glossy and three foliate. This lovely vine occurs only in the humid forests, at elevations of from one thousand to three thousand feet above the sea. It is of marked beauty and certainly merits horticultural study.

Our Hawaiian species of hibiscus constitutes one of the most beautiful floral groups of the lower and middle forest zones. There are five species, all with large showy flowers—white, pink, red, and yellow—usually solitary and axillary. The cosmopolitan *hau* tree (*Hibiscus tilacebus*) a sprawling littoral species, has rich yellow flowers, with a purple brown center. As the flowers wither they become suffused with red. The *akia-hala* (*H. Youngianus*) with pink flowers two inches long, is a small undershrub occurring in marshy places and abandoned taro patches on the lowlands and in the valleys. *H. Brackenridgei*, a shrub of four to five feet, with deciduous spines and conspicuous yellow flowers, shows preference for the semi-arid leeward ridges. The white *kokio* (*H. Arnottianus*) is a tall shrub or small tree, ten to twenty-five feet, plentiful along stream-beds in the upper valleys and ravines throughout the rain-forest. The flowers are four or five inches long, with an exserted red staminal column of four to six inches. Our rarest species is the red *kokio* (*H. kokio*) a tall straggling shrub of eight to fourteen feet. The flowers are small, two and one-half to three inches, rich red, with a conspicuous red staminal column, which has horizontally spreading stylar branches. One's first glimpse of a native hibiscus bush, leaning out over a mountain stream, its lovely flowers starred against the glossy greenery of the foliage, is a memorable experience.

The Hawaiian violets are unique in all being woody shrubs, sometimes reaching six feet in height, but with flowers like those of the familiar violets of eastern woodlands and gardens. We have half a dozen species, of the genus *Viola,* and all confined almost exclusively to the excessively humid summit ridges and bogs. In certain favorable localities they are so abundant that they richly perfume the humid air with their delicious fragrance. One species, *V. helioscopa,* has lovely large pure white blooms which project singly beyond the stiff, dark green foliage.

(*To be continued.*)

NOTE *and* COMMENT

Lignum Nephriticum.—Three or four centuries ago, the dabblers in science discovered a remarkable tropical wood which had the property of causing pure water in contact with it to become highly fluorescent. If chips of the wood were placed in water, or if water was poured into a goblet made of the wood, it became golden yellow in sunlight and a beautiful peacock-blue by reflected light. This curious property was assumed to be indicative of medicinal properties in the wood and its use in kidney troubles soon earned for it the name of *lignum nephriticum.* Although known for so long, the exact botanical identity of the plant that supplied the wood has remained in obscurity almost up to the present. From the investigations of W. E. Safford of the United States Department of Agriculture, it now appears that the wood of more than one plant has the power to make water fluorescent. The best known of these is probably the Mexican shrub, *Eysenhardtia polystachya,* but a Philippine species, *Pterocarpus Indicus,* is nearly as renowned. Since the genus *Pterocarpus* is also represented in Mexico, it is possible that other species there have similar properties just as other species of *Pterocarpus* in the Old World are known to have, though in a lessened degree.

Growth Periods of the Elm.—In spring, the elm buds, like those of other trees, throw off their protecting scales and by a lengthening of the internodes in the bud and the development of the embryo leaves forms leafy twigs a foot or more long. In the woody plants of the tropics, growth may proceed almost continuously, and when such plants are moved into temperate regions frost finds them without well developed terminal buds, but in our forest trees, the twigs grow to a certain length and then the plant rests whether cold has come or not. The elm, however, is in a different category. Early in the year it completes its spring growth, but along about August it suddenly starts up anew and within a few weeks lengthens its branches several inches more. The bright yellow-green of the new leaves forms a striking color contrast with the foliage produced earlier in the year. A number of other trees have the habit of producing a second growth late in the season, but there are few in which it is as noticeable as it is in the elm. The cause of this resumption of growth is generally thought to be connected with the amount of moisture in the soil, but the elm appears not to be so influenced, for it produces its new growth just as readily in the midst of a drouth as during more propitious seasons.

Distribution of the Oaks.—The genus *Quercus,* to which the oaks belong, is far more widespread and contains more species than those who have seen only their native species are likely to have imagined. We commonly assume that the oaks are a typically northern genus, but many species are found in the tropics. The genus seems to be especially well represented in Japan, Formosa, China, Burma, Java, Sumatra, Borneo, the Philippines and other tropical islands. South America and Africa, however, have no oaks. A writer in a recent number of the *Japanese Botanical Magazine* lists nearly 450 species of oaks. About half of these, formerly placed in the genus *Quercus* are now to be found in the genus or subgenus *Synadrys.* Many of the species in this latter group have the nuts entirely surrounded by the involucre or cup, in this suggesting their relation to the walnuts and hickories. A large number of the tropical species have entire leaves and of course, are evergreen.

Periodicity in Plants.—Rarely, if ever, does growth proceed continuously, even in the tropics. In many northern regions, the winter puts a stop to growth, and a drouth in summer may do likewise, but in the tropics where warmth and moisture are always plentiful the plants still have their resting spells and often take a vacation at what seems the most inopportune of times. Resting is also more of an individual peculiarity in the tropics and one plant may suddenly shed its leaves when the other members of its species retain them. Not infrequently, a single branch may thus rest, or it may resume growth as other parts of the plants are preparing for a dormant period. Much evidence has been accumulated to show that periodicity in plants is due to internal causes, but the prevailing idea seems to be that it is due to external conditions which are determined largely by heat, moisture and oxygen. It would be difficult, however, to explain some cases of periodicity by these latter factors. For instance, trees rapidly increase in growth after midsummer, regardless of either temperature or moisture. In July or August, new rifts in the bark of all our common trees show how rapidly new wood and bark are being added to the trunks.

Canada Lily in Northern Iowa.—The meadow lilies in the writer's locality (Emmet County, Iowa) are found rather sparingly on low prairies but are abundant in a local meadow where they present quite a display when in bloom. The flowers of these plants differ somewhat from the typical *Lilium Canadense* of the manuals. They are orange or orange-red and have the perianth segments not merely spreading as in the typical form, or even turned back as in the Turk's cap lily (*L. superbum*) but they are reflexed and closely curled together, meeting and overlapping behind the flower. Thus in a fully opened flower, not even the points of the perianth divisions project outward or backward but are curved together so that both the back and face of the flower present somewhat the same outline. Specimens of this form have been referred to *L. supurbum,* but the leaves are arranged in whorls to the top of the stem with the veins beneath rough as in the true Canada lily. The Turk's cap has the leaves smooth on both surfaces. The plant blooms about the first week in July—never so late as August, as the other species is said to do, and there is not, as a rule, more than five flowers to a stem. One botanist has suggested that it may be a transition in this territory from *L. Canadensis* to *L. superbum.* These plants seem rarely if ever to perfect fruit here. Most of the plants growing in meadows and on prairies are cut down about flowering time, but there are generally some left in woods and along their borders but these do not seed and I have never found a mature capsule. It would be interesting to know if either of the two species of lily mentioned ever have their flowers shaped as here described in other parts of the country or if this is an entirely local form.—*B. O. Wolden, Wallingford, Iowa.* [Britton's Manual mentions this form but cites no locality for it.—Ed.]

Queen Anne's Pocket Melon.—It is likely that few people would recognize the fruit which bears the title at the beginning of this note, nor is it likely that they would be helped much in their identification if told that it is also called dudaim melon and pomegranate melon. It is a rare species in our part of the world and seeds are not offered by the general seedsmen. The fruits, however, are interesting specimens, round, bright orange in color, and about the size of a hen's egg with a decided fragrance which suggests that of the may-apple (*Podophyllum*). The two plants are only very distantly related; for the species under discussion is really a muskmelon (*Cucumis melo*) and is called the variety *dudaim.* A related form has fruits of about the same size, but lemon-yellow in color and lacking in fragrance. This is the variety *chito.* It is commonly called vine peach, garden lemon, melon apple, mango melon, and orange melon and is edible when cooked.

There are several other varieties of the muskmelon, the better known being the cantaloupe (var. *Cantaloupensis*), the nutmeg melon (var. *reticulatum*), and the winter or casaba melon (var. *inodorus*). How this tiny hard-skinned melon came to be named for Queen Anne is hard to say. In any event, her royal highness seems to have a better taste in choosing fruits than she does in choosing laces if the farmer is any judge of values.

Types of Vegetation.—To the casual observer, the wild plants seem to grow without definite order almost anywhere, but the botanist knows that it is not mere chance that determines the location of flowering plants. Occasion specimens, it is true, may flourish out of their natural habitat for a time, but a patch or colony of one species is almost certain to be found in localities to which it is best suited. The division of all vegetation into drouth plants or xerophytes, water plants or hydrophytes, and middle-ground plants or mesophytes is a recognition of the important part played by moisture in determining habitat. After moisture, the character of the soil has much to do in limiting the range of plants and in forming restricted areas in which only certain types of vegetation can grow. To name but a few of these, there are the bogs, marshes, ponds, dunes, heaths, fields, woods, thickets, pastures, cliffs, meadows and cultivated grounds. Certain plants are typical of each of these regions and are often so related to the habitat as to be unable to thrive in any other. One has only to consider the water lily, pitcher plant, walking fern or cat-tail to realize the force of this. As a matter of fact, one can make pretty clean-cut lists of the plants of each region. It is only the weeds that can grow in a variety of situations, and this ability accounts largely for their being weeds. Those who have pretty well exhausted the resources of their home flora may find a new interest in listing the plants according to their habitats. It is best to begin with plants of very definite areas such as ponds, dunes, or bogs. After the typical plants have been set down, one may be puzzled to decide whether the remaining forms are true denizens of the region or not, but a little investigation will usually show that one locality has more claim to a given species than any other. Just because a few cat-tails are found in a bog is no sign that they are naturally bog plants. They are really marsh plants though a few may linger in a bog for some time. To discover the interest there is in arranging plants according to habitat, set down a list of the bog plants of your region, taking care that no plant except those that naturally grow in cranberry or sphagnum bogs is admitted to the list.

COLOR FORMS OF LILIUM CANADENSE.—There are no red specimens of *Lilium Canadense*—if you leave it to the books. Harper's "Guide to the Wild Flowers" calls them golden yellow, Mathews "Field-book of American Wildflowers" names them buff-yellow, Gray and Wood both call the flowers yellow or orange, while Britton alone hints that they may be red. Most of the botanical books are made in the East where this lily is nearly always yellow, which may account for the color attributed to it, but notwithstanding this, the flowers are practically always red in northeastern Illinois and in southern New York. Possibly the difference in color is after all a north-and-south difference, the flowers being yellow in the southern part of the plant's range and red further north. The flora of eastern New England has many elements of more southern regions in it and its lilies should naturally be yellow. Further notes on the distribution of the color forms of this species are needed. Meanwhile we have two additional notes on the subject. Mr. Leston A. Wheeler, Townshend, Vermont, writes "As regards the color forms of the meadow lily mentioned in the February number of the *American Botanist,* it may be of interest to note that in West River valley both the red and the yellow flowered forms occur. On July 10th of the present year, in company with a friend, I found both forms and noted that in the red form the segments of the perianth were shorter, broader, and less recurved than in the typical form. We also noted various intermediate forms. There seems to be no definite line where one form stops and the other begins. At the most the extreme red form, accompanied as it is with the differences in the perianth, might be reckoned a variety but not a separate species on account of the intermediate forms." Mr. C. L. Gruber, Kutztown, Pa., says "*Lilium Philadelphicum* is not common in this locality and all the flowers I have seen of it were of the usual red-orange color, but *Lilium Canadense* is common, and while the majority of the flowers are yellow, I have found them in colors ranging from clear yellow to rich red. During this summer I have found a number of meadow lily plants with flowers of the intermediate colors, red predominating in some, yellow in others."

UNUSUAL ROOT-CROPS.—"In the alpine or Andine belt of Peru, where the potato is the chief crop, three other root-crops are generally grown by the same methods and often in the same rows with the potatoes. These Andine root-crops are the oca (*Oxalis tuberosa*), the anu (*Tropoeolum tuberosum*), and the ullucu (*Ullucus tuberosus*). The tubers of all three plants are remarkably alike and similar to some of the varieties of potatoes, although the plants have no relation to potatoes or to each other. The oca is a relative of our sheep-sorrel, the anu of the common nasturtium and the ullucu of the Madeira vine. Though not attaining the size of large potatoes, the other tubers have a more attractive appearance and seem to have even better keeping qualities. In the lower part of the potato belt there is another root-crop, the yacon or llacon (*Polymnia sonchifolia*), comparable to the so-called "Jerusalem" artichoke which is supposed to be a native of Mexico. It produces large compact clusters of thick, fleshy roots tapering at both ends and with a strong external resemblance to sweet potatoes. The flesh is crisp, juicy, and has a pleasant sweetish flavor rather better than that of the Jerusalem artichoke. At elevations below 6,000 feet another series of root-crops is grown consisting of numerous varieties of rumu (*Manihot*), unchuca (*Xanthosoma*), *achira* (*Canna*) and unguna (*Curcuma.*)—*O. F. Cook in National Geographical Magazine.*

CHEWING GUM AN AID TO GARDENING.—The harm that results from chewing gum, like that from chewing tobacco, depends somewhat on who does the chewing and why. Some of the sphynx moths begin to chew tobacco as soon as they are born and keep it up until fully grown without being harmed by it. Their nerves are not shattered, their growth arrested nor their digestion impaired, for they are among the largest and strongest of their kind. There are times, also, when chewing gum may be defended. A lady of our acquaintance has discovered that chewing-gum is an ideal substance for sticking the Boston ivy and other vines to their supports until they take hold for themselves. As soon as this fact becomes generally known we expect all gardeners to throw away their tobacco and lay in a stock of gum.

MAYAPPLE WITH MULTIPLE FRUITS.—In this magazine for August 1915 we illustrated a specimen of mayapple (*Podophyllum peltatum*) with five fruits instead of the one ordinarily seen. At the time, it was not known whether the extra fruits were produced by additional flowers, or whether the phenomenon was due to an increase in the number of carpels in the ordinary flower. That this species occasionally has more than one carpel in a flower had been earlier noted by Gray, but that the occurrence is somewhat rare may be inferred from the fact that other manuals do not mention it. A visit to the haunts of the aberrant specimens when they were in bloom this year, showed that the multiple fruits are due to extra carpels and not to additional flowers. This is an interesting instance of doubling akin to that seen in the production of extra petals, and all the more remarkable in this species because it belongs to a family which has typically single carpels. Plants with extra fruits are now growing in the editor's garden.

Fruit or Vegetable.—Botanists are often importuned by their friends to decide whether certain structures are fruits or vegetables, though it would appear at first glance as if everybody should know that a fruit results from a flower while anything that is alive and not an animal is a vegetable. Fruits, therefore are always vegetables but all vegetables are not fruits. It has remained for a New York judge, however, to make a legal decision in the matter, and according to reports, he has ruled that anything that can be eaten raw is a fruit. Onions and radishes therefore ought to be fruits, but they are not, despite the legal opinion.

Bittersweet for Indoors.—Autumnal hedgerows and thickets owe part of their charm to the scarlet-seeded pods of the climbing bittersweet, or wax work (*Celastrus seandens*), a widely distributed native vine that every lover of a country ramble knows. Twisting sprays of the flaming berries are very ornamental, and if brought home and twined over book case and mantel, glow cheerily indoors all winter long. For the best effect, the sprays should be gathered in early September before the pods, which are orange yellow and completely hide the scarlet-arilled seed, have split open. The warmth of the room will cause them to open and the arils will then keep their brilliancy of color much longer than when the pods have been allowed to open outdoors.—S.

Tree Cisterns.—The baobab tree (*Adansonia digitata*), a member of the hollyhock family common in the Sudan is one of the freaks of the vegetable world. It has a large bottle-shaped trunk which, though scarcely reaching the height of sixty feet, is often more than a hundred feet in circumference and is therefore one of the largest of plants. The stubby branches which spring mostly from the top of the stem are so broad that the natives can sleep on them. The interior of the trunk is soft and spongy and, as in other trees, may decay and form large cavities in which rain water accumulates. Acting upon this hint from Nature, the natives of Kordofan have hollowed out the trunks of many specimens and in the rainy season fill them with water for use when the rains cease. A hole is often bored near the base by means of which the water is drawn off as wanted. In a recent *Kew Bulletin,* a note from an officer in the Darfur campaign mentions these trees as follows: "On our side of the border in Kordofan, they have no water for perhaps hundreds of miles and live in the dry season on water stored in hollow trees called tebaldis. They are ugly, bottle-shaped trees, all trunk, from six feet to twenty feet thick and a good one holds 1,000 gallons. Each family owns certain trees and each tree has its own name. They scrape a small pond at the foot and after a shower everybody turns out to fill tebaldi trees. A man stands at the top of the bole, about twenty feet up, hauls the water up in a skin bucket and pours it into the tree. It keeps very sweet and is better than well water." The fruits of the baobab are oval, brownish green, about the size of a cucumber and contain an edible pulp of which the monkeys are very fond. From this fact the tree is some times called the monkey bread tree.

EDITORIAL

For the benefit of our newer subscribers who, unaccustomed to our methods, expect this magazine to come out at very definite intervals exactly three months apart, it is necessary to explain that theoretically the magazine is issued on the 20th of February, May, August and November, but practically it comes out whenever the editor has time to put it together. The fact is, that since the magazine, unlike the best sellers, depends upon subscriptions instead of advertising for its revenues, the returns do not justify employing an individual on salary to look after it. The significant point is that the magazine has always paid its bills and has issued more than 100 numbers without finding it necessary to combine two issues in one as is often done. Every number will appear ultimately. Fortunately the nature of the matter published does not depend upon any set date for its value. We surmise that even the back numbers may provide rather interesting reading to those who have not seen them and to some of those who have. A year's subscription, therefore, is in no sense a subscription for the calendar year. It means the four numbers that comprise a volume. Subscriptions are begun with the number current when the subscription is received, unless otherwise ordered. Recent subscriptions are therefore begun with the present number which, though issued in autumn, bears a summer date.

* * *

Every little while we find in the public prints articles of misinformation which cause us to agree with the famous aphorism of Josh Billings that "It is a great deal better to know less, than to know so much that ain't so." Our reflections are directed anew to this observation by an article in *Something to Do*, in which a prominent New England author of outdoor books attempts to direct children in a hunt for mosses, but succeeds in mentioning only plants that by no stretch of the definition can be regarded as true mosses. He lists the gray moss (*Usnea*) which is a lichen, the club moss (*Lycopodium*) one of the fernworts, the reindeer moss (*Cladonia*) another lichen, and the scale mosses which are bryophytes but not true mosses. We cannot understand why our author was so moderate as to stop here. He could, with as much warrant have added the Spanish moss (*Tillandsia*), the flowering moss (*Pyxidanthera*), the ditch moss (*Elodea*), the rose moss (*Portulaca*) and the moss pink (*Phlox*). All these are as much mosses as any that he did mention. Never, even by chance, do the newspapers slip in an authentic article on plants. A rather extended reading of such literature inclines us to the opinion that the selection of matter for reprinting is usually entrusted to the office boy.

* * *

It has been recently proposed that we get together a group of people interested in plants for the simultaneous recording of certain facts about plants. The plan is to take up some question and call for observations on it from all interested and from these reports to make up a composite report to be published in this magazine. Already a considerable number have asked to be included in the list and we would be glad if all of our readers who are interested would join us. There are no dues, fees, or obligations of any kind. All we ask is such information as each can supply as different subjects come up. The subjects will vary with the seasons. Perhaps it may be a list of the fragrant flowers to be constructed, perhaps data on the time certain flowers open or stay open, perhaps a list of herbs that bear berries, etc., etc. Replies can usually be sent in on a post card. Those who will join us in this new kind of botanizing should send in their names as soon as convenient. Reports will not be compulsory but we hope to have full reports each quarter. The first subject will be announced in the next number.

* * *

A joint resolution was recently introduced in Congress for the purpose of making the mountain laurel (*Kalmia latifolia*) the national flower, and the unthinking public has gone in for it with a whoop. A national flower, however, cannot be made by fiat. We may legislate till the cows come home, we may organize societies to advocate the merits of our favorite flower, we may write letters to the papers and we may get children and other childlike individuals to select a national flower by vote, but until some plant looms large enough in our national history to merit the title, we shall have no national flower that the title really fits. In every community there are certain individuals bent on filling long felt wants even if they have to first create the aforesaid wants. It seems to be some individual or group of individuals of this kind who are worried about the national and State flowers. The sentimentalist thinks how lovely it would be if his State and nation had a distinguishing flower, such as certain countries of the Old World have, and immediately rushes off to the legislature to get the error corrected. He never stops to think that a national flower must be significant to be acceptable. The State flowers of other countries are intimately connected with historical events, and any real national flower for the United States will have the same origin. It is amusing, therefore, to see legislatures composed of men too woefully lacking in plant-lore to know a fern from a carrot, adopting as State flowers, plants not native to the State, or even to the United States. As for the mountain laurel, its restricted habitat, its short season of bloom, the difficulty of making it grow at all in most of the States, to say nothing of its habit of crouching in the shelter of stronger species, makes it about the worst specimen imaginable for a State flower. We have a suspicion that some New Englander suggested it originally. There is reason enough for applying such names as sunflower, palmetto and pine tree to certain of the States and reason enough for these States adopting the particular species named as their floral emblems, but for others to choose the rose, violet, buttercup, golden-rod and the like is sheer nonsense. Even when the selection is appropriate, it is not always safe to assume that it will be adopted. We do not anticipate that the nutmeg flower will ever be adopted by one of our commonwealths as the State flower. Perhaps, however, it is just as well to let the lawmakers amuse themselves with botanical legislation. It will keep them out of other mischief meanwhile.

BOOKS AND WRITERS

The Lorquin Natural History Club of Los Angeles, California, has issued the first number of a monthly publication to be known as *Lorquinia*. Notes on local natural history fill the pages of the first issue. A magazine of this kind ought to do much to advance an interest in nature in the region which it serves.

A 40-page publication entitled "Flowers for the Hardy Garden," really the catalog of the Twin Larches Nursery, West Chester, Pa., is one of the few things in this line that appeals sufficiently to the reviewer to get a notice here. It reads as if it was written by a man who really understood and loved his specimens. Moreover, it is the first catalog we have seen that gives sufficient information about the individual species to enable one to form a definite idea of their appearance and where and how they should be planted in the border. This catalog is going on the special shelf where we keep a few good ones that we consult every little while. Probably our flower gardening readers will also find it of interest. It is mailed free.

It seems to be settled, at least by the botanists, that a textbook of Botany should begin with the structure and physiology of flowering plants, pay some attention to the lower forms of plant life, and end with more or less matter relating to evolution and plant breeding. If this be the most desirable arrangement—which we are sometimes inclined to doubt—we can only judge new books by the fidelity with which they follow scholarly tradition and the facility shown in presenting the subject in intelligible form. A new volume entitled "Fundamentals of Botany" by C. Stuart Gager, Director of the Brooklyn Botanic Garden, is an interesting addition to the books of this class which depend upon the method of presentation for much of their attractiveness. In it, old topics are made new by a very modern and spirited treatment, and a wealth of new, or at least unfamiliar, illustrations adds to the value of the text. The book, however, is far too exhaustive and circumstantial for the use of high school pupils, but it should meet the needs of college students admirably. The chapters on experimental evolution, heredity, and kindred subjects supplies a want often felt in books of this nature. The book is well printed, contains nearly 600 pages and is bound in flexible covers. It is published by P. Blakiston's Son & Co., Philadelphia, at $1.50 net.

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OSSAWATOMIE PINE TREE.

THE AMERICAN BOTANIST

VOL. XXII JOLIET, ILL., NOVEMBER, 1916 No. 4

The summer warmth has left the sky,
The summer songs have died away;
And, withered, in the footpaths lie
The fallen leaves, but yesterday
With ruby and with topaz gay.

Yet through the gray and sombre wood,
Against the dusk of fir and pine
Last of the floral sisterhood,
The hazel's yellow blossoms shine.

—Whittier.

THE OSSAWATOMIE PINE TREE

By Charles Francis Saunders.

ONE of the trips expected of every tourist in Southern California is by the remarkable electric railway to the top of Mount Lowe—a peak of the Sierra Madre of California. On the very summit of this peak stands a small tree which has rather unique pretensions to interest. It is a nut-pine of the sort known botanically as *Pinus monophylla*—the single leaf pine—and is the solitary specimen of its species within a radius of many miles.

A generation ago on the flank of this mountain, was the home of Jason and Owen Brown and their sister Ruth Thompson, children of John Brown, the Abolitionist. One autumn day in 1887, the two brothers came upon this little tree and noticed that rain and wind had so exposed its roots that its hold on life was precarious. Taking pity on its plight, the kindhearted men brought earth in their tin dinner bucket, covered the roots and built about them a support of stones. In time the story of how the tree owed its life to the sons of John Brown of Ossawatomie gained for it the local name of the "Ossawatomie pine tree".

It is still a thrifty specimen, but of the thousands of annual visitors to Mt. Lowe, few know of the thread that binds this sturdy little pine with one of the stirring epochs of our nation's history; for Owen Brown was the companion and able lieutenant of his father in the latter's picturesque carrer both in Kansas and at Harper's Ferry. Owen died in 1889 in his cabin a few miles from this pine tree; and his solitary grave, marked with a rude granite head stone, crowns the summit of one of the Sierra foothills close to his old mountain home.

HOW PLANT FOOD IS FORMED

By Willard N. Clute.

THERE is probably no phase of botany about which so many misconceptions exist in the popular mind as the formation of plant food, and the gardener, nurseryman and plant lover share in the general obfuscation. Nearly everybody seems to think that plants get their food from the soil, entirely overlooking the fact that a large number of plants, such as perching plants or epiphytes, thrive though not rooted in the soil. As a matter of fact plants get their food from their leaves—at least that is where it is made.

Plants differ from animals in that they form food from simple chemical elements, while animals are unable to do this and can only take the foods formed by plants and break them down into their original elements again. When it comes to the *use* of food, however, plants are like animals and digest, assimilate and break it down in practically the same way.

It is not true that plants differ from animals by giving off oxygen in breathing while animals give off carbon-dioxide. In breathing, plants and animals are exactly alike so far as the gaseous exchange is concerned. Both take in oxygen and give off carbon-dioxide. Where plants really differ from animals is in possessing another function, peculiarly their own, known as photosynthesis, by means of which food is formed. In this process, carbon-dioxide *is* taken in and oxygen given off—just the reverse of breathing. This latter exchange rather overshadows that which results from breathing and has probably given rise to the popular misconception regarding it.

Plant food is formed in the leaves and other green parts of plants from the carbon-dioxide absorbed from the air in photosynthesis and soil water taken up by the roots. The energy necessary to combine these into food is secured by a multitude of green bodies called chloroplasts in the cells. These chloroplasts stop some of the light rays and probably turn them into some form of electrical energy. When it is known that plants get their energy from sunlight, it is easy to understand why all green plants must have light and also why plants without chlorophyll, as the green coloring matter is called, cannot form food even in the light. Fungi and the colorless flowering plants have to depend upon food already formed and must live on other plant or animal parts, living or dead. They can also grow as well in darkness as in light.

The question of the harmfulness of plants in the sickroom is also connected with this subject. When daylight ends, photosynthesis ceases and with it the exhaling of oxygen. The carbon-dioxide given off in breathing, however, continues, though in such small amounts that it requires a rather carefully conducted experiment to detect it. Under these circumstances a whole roomful of plants would not use up as much oxygen in a night as would a single lamp. We must remember, too, as regards the general effect of plants on the health, that invalids are often sent to the country to recuperate where there is little else but plants. When it comes to *flowers* in the sick-room, however, that it quite another story. Flowers often give off odors that are harmful even to persons in good health but this is not a result of breathing or of the formation of plant food.

THE EVOLUTION OF HERBS

THE origin of our plants has always been an attractive subject for speculation by the evolutionist. As data accumlate, it becomes increasingly evident that the first plants were evergreen, perennial, and, so far as land plants are concerned, tree-like in form. Herbs seem to have been a later response of vegetation to increasing cold and drouth which they encountered in less favorable parts of the earth. Such forms, however, enabled vegetation to exist in regions where other forms could not grow. In practically every instance, where plant families contain both herbs and trees, the woody forms have been shown to be earlier and more primitive. The cycads, the pines, spruces and other cone-bearers from which modern flowering plants appear to have descended, are all woody plants and appear always to have been so. Even the simpler flowering plants, such as the catkin-bearing Amentiferae and the relatives of the butter-cup family are nearly all tree-like in form. If the inference is correct that herbs are due to cold and drouth, we would naturally expect the plants of cold regions to be largely herbs, and this turns out to be the case. As regards the effect of this herbaceous vegetation on the development of modern forms of life on our planet, the following from "The Evolution of Herbs," by Dr. Edmund W. Sinnott in *Science* is pertinent.

The great advantages conferred by the possession of an herbaceous habit of growth in a region subject to low winter temperatures are obvious, for such plants are able to complete their cycles and to mature seeds in the warm summer months and they can then survive the cold of winter in the form of resistent seeds or by hibernating in the ground. Only the hardier types can maintain permanent aerial stems under these conditions. The more delicate woody families have either been exterminated outright in temperate regions or have survived only by assuming an herbaceous habit and thus flourishing in that part of the year which is free from frost. As might be expected if low temperature has indeed been the determining factor in the development of herbs, most of those families which are well able to survive cold as trees or shrubs and which form the bulk of the woody vegetation of the north temperate zone—the willows, birchs, oaks, beeches, walnuts, hickories, wax myrtles, elms, hollies, maples, heaths, buckthorns, lindens, planes, sumachs, cornels, and viburnums—are families which are almost entirely without herbaceous members. Being hardy, they have not been forced to adopt the herbaceous habit.

As to the details of this change in growth habit, we cannot, of course, be sure, but in those forms which it did not kill outright, the increasing cold probably effected a gradual reduction in size and an attendant shortening of the time necessary to reach maturity until very dwarf forms were produced which were able to develop from seed to seed in a year or two, and which could be killed back to the ground every winter—in short, perennial herbs. The herbaceous vegetation in Arctic and alpine regions today, is still composed almost entirely of such plants. The annual herbs, seem to have developed from this primitive type under more favorable environment, where a plant growing from seed, and thus without a subterranean food reservoir to give it a rapid start, could become large enough in a single season to reproduce itself.

The northern vegetation thus developed, proved extremely hardy and aggressive, and was able not only to overspread the great continental area of the north temperate zone, but to invade as well, the tropics and even the antipodes. The presence of a large number of typically northern genera of plants in Australasia, southern South America and South Africa, often separated from their related forms by the whole width of the tropics, has long been recognized as one of the most fascinating problems of plant distribution. It is important to note, that this invasion of northern plants (nearly 200 genera are known) which has been so successful in penetrating far southern regions and which display so well the "wonderful aggressive and colonizing power of the Scandinavian flora" to which Wallace and others have called attention, has in reality been an invasion of *herbs,* for almost none of the northern trees and shrubs have participated in it.

Herbaceous plants have also been developed in the south temperate zone, apparently in response to the refrigeration of climate there in the late Tertiary. Antarctic herbs were doubtless among the very last plants to leave the polar continent as the glaciers advanced. They are still almost all alpine or cold-loving perennials, and have as yet failed to give rise to the aggressive lowland annual type.

Refrigeration of climate was doubtless not the only factor in the development of an herbaceous vegetation. A large body of such plants seem to have originated in the arid regions, where they spring up rapidly and produce seeds during the rainy season, thus bearing precisely the same relation to extremes of moisture that arctic and alpine herbs do to extremes of temperature. The assumption of a rapidly climbing habit, especially in the tropics, has also resulted in the development of an herbaceous type of stem in such families as the melons, milkweeds, and passion flowers.

But whatever the cause of their origin, herbs have proved themselves an exceedingly versatile and aggressive type of vegetation under almost all climatic conditions. The reasons for this dominence are not far to seek. They are able not only to thrive in cold and arid regions but, from the brevity of their life cycle, can take advantage of temporarily favorable conditions of any sort. Their evident and great superiority over woody plants in rapidity of dispersal and ability to invade new areas quickly is due in large measure to the fact that their interval from seed to seed, instead of being many years, is only a few months. Every seed may itself become a center of dispersal in a season's time. The amount of seed produced, too, in proportion to the bulk of the plant body which has to be developed is far greater among herbs than among woody forms. Owing to the rapid multiplication of their generations, herbs are capable of more rapid evolutionary change than are trees or shrubs, and hence are able to adjust themselves more rapidly to new conditions. With these various advantages, it is not surprising that the herbaceous habit today characterizes not only great numbers of the commonest and most dominant native plant species in all parts of the world, but also that huge array of hardy and ubiquitous plants which we know as weeds.

This radical change in the growth habit of many plants from the woody to an herbaceous type which has taken place for the most part since the beginning of Tertiary time has not failed to exert an important influence on animal life. It may well be connected with the rapid evolution of mammals which we know to have occurred after the early Tertiary. To quote from Chamberlain and Salisbury:

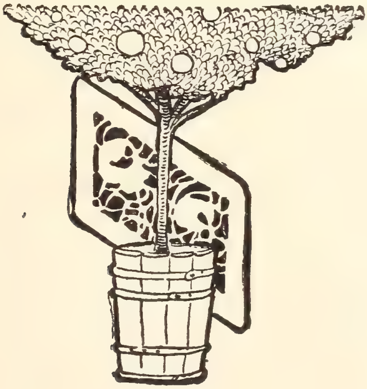
> The earliest Eocene mammals were much more primitive and obscurely differentiated that even those of the middle Eocene, and this rapid backward convergence seems to point to some set of conditions which caused an exceptionally rapid development of the great class at this stage, whatever their previous history had been. The coming into a new domain of

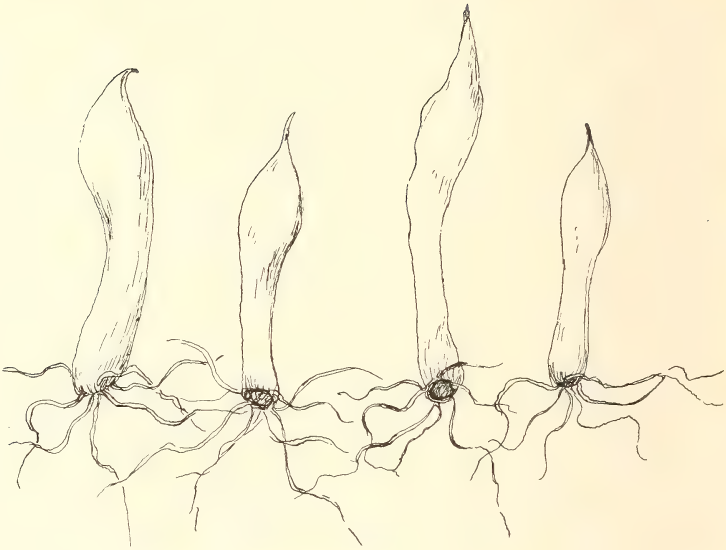
rich and varied conditions, whether by immigration or indigenous development, may be safely included among those conditions.

Is it not reasonable to suppose that the appearance of a great body of herbaceous vegetation just at this time was one of these conditions? This would affect directly the development of all herbivorous types and indirectly of many others. In the evolution of the tooth of the herbivora, indeed, we can trace the change from a sharply cusped type suitable for chewing tough leaves and twigs to the modern flat condition which is capable of dealing only with the softer herbaceous tissues.

Far more important, however, is the part which the herb has played in the development of human civilization. Primitive man seems to have been mainly arboreal in his habits, or at least primarily a forest dweller, and the wood, bark, and fruit of trees and shrubs were of supreme importance to him as sources of shelter, fuel, implements, clothing and food. One of his first steps from this barbarism toward civilization was to enter the open and begin the practice of agriculture. Those plants which most commended themselves to the earliest tillers of the soil were probably not the slow-growing trees and shrubs, but rather the herbs, since the rapidity with which they grow and reach maturity makes possible their culture even among such roving tribes as were our North American Indians. Only as man acquired a settled place of abode and a more permanent form of society could he begin the culture of woody plants in orchard and vineyard; and it is only in very recent times that agriculture has extended beyond these fruit bearing trees and shrubs and, in the form of forestry, has begun to treat the timber trees, themselves, as a crop to be cultivated.

The marked superiority of the herb in ease of agricultural manipulation, together with the wide variety of uses of root, stem, leaf, and fruit, have given it an increasingly high place in man's favor. To be sure, trees and shrubs provide us with timber, fuel, paper, rubber, fruit, nuts, coffee, tea, cocoa, vineyard products, turpentine and many drugs and items of lesser consequence. Among herbaceous produces, however, are found all the cereals and vegetables, together with sugar, tobacco, most of the fibers, certain of the fruits and many other valuable commodities. In addition to all this, the animal industries, which are the sources of milk, meat, leather, and wool, are dependent upon herbs. The dominance of such plants in agriculture is shown by the fact that in the United States they contribute 96% of the value of the products of this fundamental industry. Without herbs, the feeding and clothing of our great populations today would be quite impossible, and though it is conceivable that with the advance of science civilized man might possibly dispense with woody plants, in the absence of herbs he would perforce revert almost to savagery again. Human society is an herbaceous product.





BULBS ON STALKS

By Willard N. Clute.

ACCORDING to the dictionary, a bulb is a short thick stem. When Nature decides on a new form, however, she does not consult the lexicographers and in consequence we often get specimens that do not conform to the definitions. In the present instance, the curious elongated objects shown are really bulbs, for they occurred among hundreds of the conventional type, but they are so much like chubby sprouts, that at first glance they seem to be quite unrelated to the usual form. When planted, these stalked bulbs become normal plants of the wild hyacinth (*Camassia esculenta*), and if given room they will form rounded bulbs like those of the onion. When the regular bulbs are allowed to grow in one place long enough to produce one or two generations of bulblets, the crowding that results produces these curious forms. Many of the bulblets become short fat little bulbs, but those nearest to the mother bulb grow up around it as if trying to make sure of a good start in spring. They are closely pressed against the parent bulb, and in most cases one can discern the curve in the side of the stem where the bulblet came in contact with its parent. Some of these stalked bulbs are three or four inches long, though not much thicker than a pencil.

THE WILD FLOWERS OF HAWAII

By Vaughan Mac Caughey.

(*Concluded*)

The genus *Scaevola*, with eight species, is abundant, and ranges from the sea-shores to the upper limits of the rain forest. The natives call it *nau-paka*, and tell a pretty legend concerning the split corolla of the flower, this being attributed to the angry fingers of a certain fair maiden who had quarreled with her lover. So every *nau-paka* blossom appears to have been torn. The corollas are beautifully pubescent within; in color white or bluish, with fine purple streaks. The one exception is *S. glabra*, with deep-yellow curved tubular corollas, nearly two inches long. The Scaevolas are shrubs or small trees, with alternate simple foliage and conspicuous flowers solitary or in axillary cymes. Like many of our Hawaiian shrubs, they flower continuously, and brighten many a valley slope and sea-shore with their tattered blooms.

Two large genera of Hawaiian composites are *Lipochaeta* and *Coreopsis*, each with a dozen species. These are all herbaceous perennials or woody shrubs; many are decumbent or prostrate. They occupy a wide variety of habitats, from arid to humid, and from sea-shore to the summits. The floral heads are yellow, and form conspicuous masses of golden bloom. The bright patches of yellow that adorn the dripping mountain trails and ledges, and that soften the harshness of the dry rocky coastal regions, are generally one of these species. There are also a dozen native *Raillardias,* mostly high-mountain shrubs and trees, which are covered with yellow flowers during their blooming seasons.

Hawaii's most famous plant is undoubtedly the silver sword (*Argyroziphium Sandwicense*). The name refers to the basal cluster of closely packed, long, curved, dagger-shaped leaves, which are densely covered with beautiful lustrous silvery-white appressed hairs. The Hawaiians call this plant *ahina-hina,* which means silvery gray. This remarkable plant is confined to xerophytic habitats on the high mountains of Maui and Hawaii. At flowering time the stem elongates into a showy foliose raceme four to eight feet high, with a profusion of large floral heads. The disks are yellow, the rays are dark rose-purple. The spectacular beauty of this plant, both in its vegetative condition, and when in full flower, is a frequent theme for eulogy in the tourist literature of Hawaii.

The great volcanic mountain of Hale-a-ka-la, home of the Silver Sword, is girdled at an elevation of two to three thousand feet above the sea with a dense belt of a bright flowered endemic mint, the *pahaka* (*Sphacele hastata*). This is a herbaceous perennial of three to five feet in height, covered with sticky tomentum, and emitting a heavy menthene odor. The hastate leaves are six to nine inches long by two to four inches broad, and are thick papery in texture. The flowers are clustered in showy terminal panicles. The purple red corolla is an inch long, scarcely bilabiate. The strong odor and conspicuous blossoms of the *pahaka* are familiar to all who have tramped over the dreary and rugged waste-lands of Hale-a-ka-la's leeward slopes.

We have a number of indigenous geraniums, seven in all, chiefly shrubby perennials, and largely confined to the high mountains of Maui and Hawaii. The flowers are white and not especially noticeable. One species, *G. arboreum,* often developes a trunk of three to four inches in diameter. Its flowers are dull red, in cymes on short lateral shoots.

Our two buttercups, *Ranunculus Mauiensis* and *R. Hawaiiensis,* are both perennial, the former a spreading shrub, the latter erect and two to four feet high. Both are upland forms; *Mauiensis* occurs on all the islands above two thousand feet elevation; *Hawaiiensis* is confined to East Maui and Hawaii, above four thousand feet elevation. Both have bright yellow flowers; those of *Mauiensis* are small and in diffuse open panicles; those of *Hawaiiensis* are larger and showier, and massed in closed corymbs. The basal leaves of each are on petioles a foot long, and have dissected blades from four to six inches in diameter. In the tropics the Ranunculus group is largely restricted to the higher mountains, and our Hawaiian species exemplify this rule.

Two endemic labiate genera that are widely scattered through the woodlands and mountains are *Phyllostegia,* with about sixteen species, and *Stenogyne,* with about eighteen. The number of species is approximate, as there is much variation, and numerous forms are weakly defined. They are all branching undershrubs, some prostrate, others decumbent, and others erect and trailing over the surrounding vegetation. The flowers are small and clustered in axillary and terminal racemes and panicles. The *Phyllostegias* have white flowers, often suffused with purplish or pinkish; those of the *Stenogynes* are either greenish yellow or purplish red. These plants grow chiefly in the higher levels of the rain forest, and illumine many of the dark and otherwise gloomy ravines with their pleasant color masses.

There are half-a-dozen *Lysimachias,* of which all but one have large conspicuous purplish flowers. These grow singly in the axils. The plants are low or tall shrubs, varying in stature from one to eight feet. *L. spathulata,* with greenish-yellow flowers, grows along the sea-shore; the others are characteristic of the valleys, ravines, ridges, and bogs of the rain forest zone, and ascend to an elevation of five thousand feet. *L. daphnoides,* the *kolo-kolo kua-hiwi,* "mountain creeper" of the natives, is one of the beautiful-flowered plants of the famous summit swamps of Mount Wai-ale-ale of Kauai. The purple blue flowers are large and fragrant, and stand out showily among the thick, leathery, dark-green leaves.

A distinctively Hawaiian flower of rare charm is the native begonia, *Hillebrandia Sandwicensis.* The genus is endemic; there is but the single species, and the natives call it *pua-maka-nui,* the big-eyed flower. Few people, either natives or whites, have seen this lovely plant, as it grows only in deep shady ravines and glens in the rain forest, and on the almost inaccessible faces of exposed rainy precipices. The succulent stems rise from a tuberous rhizome to a height of two to five feet. The leaves are borne on petioles of two to six inches; the leaf blade is four to eight inches in diameter, and irregularly five to nine lobed. The many-flowered corymb arises from the axil of the uppermost leaf, and is four to eight inches long, bearing a profusion of brilliant pink or rose colored flowers. The plant as a whole is very attractive and shows real horticultural merit.

The Hawaiian *Gardenias* are noteworthy among the beautiful wild flowers of the archipelago. Both of the two endemic species, *Brighamia* and *Remyi,* have an abundance of large, fragrant white flowers. Brigham's gardenia is a shrub of six to twelve feet, with shining dark-green leaves. It inhabits arid leeward slopes and ridges. Remy's gardenia is rare, and occurs scatteringly in moister habitats than the other. It is a tree of thirty or forty feet. The young shoots copiously produce a glutinous exudation which covers the leaves as with a layer of shellac. In both species the lovely, heavily-scented flowers are terminal and solitary.

Undoubtedly the crowning glories of Hawaii's floral world are her unique woody *Lobelias,* of which there are *nearly one hundred species!* Of the six genera, five are endemic, and practically all of the species are endemic. The corollas of these highly specialized and interesting plants are long, curved, tubular, and deeply slit along the back. In one remarkable monotypic genus, *Brighamia,* the corolla is salvar-shaped, with a straight, entire tube three to five inches long. In color the lobelia flowers are greenish white, cream, pale pink to deep rose, lilac, purple, or dark bluish. The lighter ones are often marked with darker stripes. Some of the inflorescences attain great size, spreading out several feet from the stem, and laden with flowers in various stages of development. Many of our Hawaiian Lobelioideae are trees, ten to thirty feet in height, with naked stems closely marked with leaf-scars, branching sparingly, and the foliage crowded at the ends of the thick branches. The lobelias occupy a wide variety of habitats and elevations, but are largely restricted to the humid forests, exposed rainy slopes and precipices, and other distinctively hydrophytic regions. Many species are highly precinctive. The range of variation and polymorphism is phenomenal. Many forms are on the verge of extinction, or are already extinct. The apparent over-specialization of the floral structures strikingly reminds one of similar conditions among certain orchid genera. Like many other elements in the Hawaiian flora and fauna, the lobelias seem to be the vestiges of a much more extensive primitive flora.

A DAY AND NIGHT ON MOUNT ADAMS

By Walter Albion Squires.

TO the nature student a glacier-clad mountain is a source of never-failing interest and inspiration. Whether he sees it catching the first tints of the coming day, or lighted by the sunset glow, or lying cold and still under the midnight stars, it has for him a call and a challenge. For some three months I had been living in the little village of Troutlake, Washington, and almost at the foot of Mount Adams. I had felt the call of the mountain almost every day. The sight of it gave me the climbing fever. I longed to see what Nature had wrought up there among the crags, snowfields, and glaciers. At last the time came when I was free to attempt the scaling of the vast and rugged old volcanic cone. Guides and riding animals were to be had, but I chose to go alone. I knew from former experiences that Nature yields her best to us when we are unhindered by human companionship. As for riding horses and pack animals that stray away at night and lead you a weary chase ere they are recovered, I wanted none of them. With a good pack sack a man can carry forty or fifty pounds with comfort and be independent.

I made an early start. At half past two in the morning I was off, down the silent streets of the little sleeping hamlet. I crossed the White Salmon River on the boom dam of the lumbermen. Beneath me the murmuring waters glinted in the starlight. It was quite dark under the tall pines and firs; they shut out the light from the stars, and starlight does not do so bad when we cannot get any other light. I could not see the trail but I knew its general direction, having been over that part of it before, and one soon gets in the way of keeping the trail with his feet, when his eyes can no longer serve him. The trail through a forest is firm to the tread, but a step off of it puts one on the soft carpet of the forest debris. Wild things screeched weirdly now and then off in the dark woods, and occasionally something would go pattering off over the fallen leaves. I knew what made the pattering; it was the Neotoma or wood rat, a mild-eyed and harmless night-prowler in the forests of the West. I did not know what sort of creature was doing the screeching but I encouraged myself with the thought that, taken all in all, the forest is far safer than the city.

I had planned to be on the highlands near timberline by daybreak and I was there on time. Daybreak at timberline is an experience never to be forgotten. While all the lowlands were yet in deep shadows, the great snow-clad cones of the ancient volcanoes, which dot the northwestern part of our country, began to stand out against the sky clothed in rosy light. In the south, Mount Hood rose into the sky with its sharp spear point of snowy granite. Farther away Mount Jefferson could be seen. In the west Mount St. Helen's symmetrical cone was all aglow with the first-born sunbeams of the new day. As it grew lighter, I began to notice the flowers. It is not my purpose to give a list of all the flowers I found on the trip; I shall mention only a few which were especially interesting to me. The most conspicuous plant of these timberline areas is a tall liliaceous plant (*Xerophyllum tenax*). It grows three or four feet high and consists of a bunch of rough grass-like leaves from the midst of which springs the slender flower spike. Somewhere on this spike is a puff of snow-white blossoms as large as your two fists. Above the ball of bloom are the undeveloped flower blossoms, and below it are the ripening seed pods and withered corollas. It blooms for several weeks, the blossoming beginning at the bottom of the spike and climbing up until it ends at the summit.

On a grassy slope, fresh and green as a Kansas prairie in May, I came upon some *Calochorti*—Mariposa tulips, they call them in California; only these were of a kind I have never seen in the Golden State. An examination of the flowers showed them to be *Calochortus Lyalli*. This flower is very much like the *Calochortus* called in Utah the "Sego Lily" and the state flower of that commonwealth. A little farther on were many bright yellow *Erythroniums*. I suppose they were *Erythronium grandiflorum* though they did not look quite like the flowers of that species I had been familiar with in Northern Idaho. Not far from the *Erythroniums* I came to my first snow. It was a field some acres in extent, much discolored and soft from the sunbeams which were beating down upon it with almost tropic heat. Several kinds of plants grew almost up to the very edge of the melting snowfield. The little one-flowered *Dicentra*, and the alpine phlox were the most abundant of these flowers crowding upon the edges of the snow.

I crossed that snowfield and several others and made camp beside a little icy stream that burst noisily out from underneath a large field of snow. Back of this snowfield was what I at first though was a very steep and rocky cliff. I afterward found that it was not a cliff at all, but the terminal moraine of a tremendous glacier which swept down from the very crest of the great mountain. As I was resting for a moment after having eaten a hastily prepared breakfast, some of the rocks up near the summit of the moraine broke loose and came thundering down, plunging out of sight in the heaped-up snow at the foot of the moraine cliff. That was a cliff of rock in motion; pressed by the millions of tons of ice behind, it was moving down the mountain side and I was right in its path. There was no need for alarm, however, it was probably moving no faster than a few feet in a century; there was plenty of time to get out of its way.

Near my camping place I found a little flower which I had long wished to see. I had often read of it in the writings of John Muir; *Cassiope Mertensiana,* the books call it. John Muir always called it cassiope, and if you have ever seen the picture of Muir and Roosevelt taken on Glacier Point, Yosemite, you have seen a sprig of this same plant in the buttonhole of Muir—great-souled man of the out-of-doors—he loved it as Linnaeus loved the twin flower!

After breakfast I started to climb the rocky ridge to the east of my camp. I intended to spy out a route to the summit so as to be ready to attempt the ascent the following morning. I found that this ridge lay between the glacier, at the foot of which was my camp, and another glacier equally large which swept down the southeastern side of the mountain. Between these two glaciers the ridge I was on ran like a great Cyclopian stair apparently right up to the summit. Carried away with that exhilerating motion which makes it hard to turn back when one has set his face toward the heights of a great mountain, I climbed on and on. I had not intended to attempt the ascent that day, but finally changed my plans and made up my mind to go to the top if possible. I supposed I was far above all vegetation, other than the gray lichens on the stones, for on each side of me a few feet away were the everlasting snows. I was surprised, therefore, after a time to notice down among the huge blocks of broken lava, where a little soil gave them a precarious foothold, were some tiny blossoming plants. They proved to be plants of the mustard family, *Arabis Suksdorfii.* No other species was found growing at such an elevation. It must have been all of ten thousand feet above the sea.

These high altitudes were not quite destitute of animal life either. An American pipit flew out from among the broken lava blocks and went skimming away across the snow. Hardy little mountaineer, it must love the craggy peaks, for it makes twice a year a journey of more than a thousand miles for the sake of spending ten weeks on these icy summits!

Perhaps we need not wonder at it, for birds are home-lovers, and a bird's home is where it builds its nest. Butterflies went by on the wing occasionally. I don't know what they were doing away up there on top of Mount Adams, but they were there. I also saw a good many spiders laying in the snow stiff with cold. How did they get there? I do not know, unless it be that they were taking a journey across the world in those cob-web flying machines of theirs and met disaster by being blown upon these snowy slopes above the clouds.

I found that my Cyclopian stair did not reach the top of the mountain as I had supposed. It ended in a steep snow slope. I had a desperate climb before I stood on the highest point of that old mountain, but I reached it at last. I was twelve thousand one hundred eighty-four feet above the sea. Mount Adams is unlike the other volcanic peaks which arise around it. They are cone-shaped, Adams is a great knife-edged ridge. It slopes up gradually on the north side and on the south side, but on the east and west it falls off in awful perpendicular declivities. From the summit Mount Ranier, hidden before, came into view.

Far away in the north, near the Canadian line, the triple peaks of Mount Baker arose on the horizon. I looked down on miles and miles of forest, even-topped as a field of wheat. Off in the southwest the Wilamette Valley lay buried in clouds. On the east the plains stretched away in a yellow haze of wheat fields, for it was harvest time.

The wind cut through me and my fingers were so numb that I could hardly write my name in the book kept in an iron box on the summit.

The sun was now nearly down and I knew I must hurry to reach camp before dark. The descent was much more easy than the upward climb had been and I reached camp just at dusk. There were not many trees near me, that is trees that were living ones; but not far away was a clump of dead white-barked pine. I gathered fuel from these and started a fire. It was most excellent fuel, burning with a steady flame and dying down into a great heap of glowing embers that lasted a long time. I had never before seen pine that made a fire like that. I suppose it may be due to the fact that the trees grow very slowly at these high altitudes.

What a night that was! I lay in my blankets and looked up into the universe of stars. How bright and steady they shone in that clear high atmosphere; beacon lights in the infinity of space—"street lamps in the city of God!" In the morning the little stream that came from the snowfield was silent. It was frozen solid. I had been up most of the night gathering fuel for the fire, if it had not been for the fire I believe I should have frozen to death.

I reached home that same evening tired and footsore, but feeling that the time had not been wasted, for I had become better acquainted with the great mountain, and perhaps, in some small way better acquainted with Him whose handiwork is the everlasting hills.

THE STARS OF AUTUMN

NO one, it seems, has ever called an aster anything but an aster. Aster is the name given by the pedants, it is also the name used by the extreme unlearned. Spectacled scientist and tousled peasant for once use the same language. An aster is an aster.

Away back when botanies were not thought of someone admired the purple and white delights of autumn and called them stars. Aster is the Greek word for star. No one ever improved on this designation. They are the earth stars of autumn. They are the year's last floral fulfillment. They are the completion of the cycle; solid, substantial, self-reliant; yet wonderfully beautiful. Only the freakish witchhazel waits to bloom after the asters.

So common are the earth stars that they fail to command adequate attention. Every wild roadside is alive with them. Every pasture displays them, every woodland, every brook vale, every waste desolation of suburban metallic garbage. At home in the most entrancing dell of the remote ravine lands and equally at home where the tin cans fester and rust in shameful heaps they mark the year's last effort to beautify the world. The goldenrod is their lesser helper; for the goldenrod is more easily discouraged and her satisfied hue carries no message of forward-looking cheer comparable to the azure hopefulness of the asters.

Of asters there is an abounding variety. Commonly they are classed as purple or white; but this is absurdly superficial. Purple is no proper classification of the many shades of tinged blue which the frost-nipped fields and woods display. And even the less attractive white kinds are of many varieties. The weediest of all the cheeky, shrubby species that advance even to the ugly hedgerows of civilization and make them less ugly are worthy of admiration and respect.

Incomparably the most beautiful of the aster tribe is the misnamed New England aster, which is common outside of New England, but rather rare in New England. This is the queen of the autumn gypsies of Flora's world. She is most at home where she can queen it from some quiet brook bank, bending over the ripple, or haughtily receding to the sunny slopes. Hers is a regal purple far more magnificent than any the other species can show, and by some perversion of compensation her flower head is much larger and showier than that of any other aster. She is the one aster that irresistibly demands separation and classification. Of the others there is little obvious distinction; the botanists may note the heart-leaved, arrow-leaved, prenanthoides, and dozens of others, but to the man in the fields they are all mere asters. The New England monarch is strikingly different; so different, in fact, that it is almost difficult to class her as an aster at all.

Unadvisedly at times *Novae Angliae* consents to grow by the roadsides. She is not frequently foolish enough thus to display her allurements. It is almost a certainty that her blossoms will be plucked in armfuls wherever they are seen for she is not only the queen of the autumn but a regal personage among all the flowers of the year. With wisdom, therefore, she usually seeks the hidden brook nooks, where she majestically rears herself higher than a man's height and displays her splendor without fear of ravishment. While her smaller cousins and courtiers range the roadside in dense masses, confident that their lesser and excessively common charm will assure their immunity.

It is well to go star gazing in autumn and to gaze downward for earth stars. All the stars are not in the vaulted firmament. We are, ourselves, earth creatures and the earth stars are more comprehensible than the stars of the sky with their sense-dulling distances and magnitudes. But their message is the same, the message of life and wonder. Without wonder life would be little.—*Cleveland Plaindealer.*

TRAINING IN HORTICULTURE

I THINK that the college bogy has been held up too much. I don't believe that a college course at all fits a man for assuming charge of even a small estate. The drawbacks in our agricultural colleges today are, that really practical men are to a large degree lacking. I do not mean to infer that the professors are not bright, intelligent men; but how many of them have had any great degree of practical horticultural training? When our colleges select men who are first class *growers* to have charge of their greenhouses and grounds, men who will be free from petty interferances from the more purely theoretical teachers then they will turn out young men who can with greater confidence apply for positions where practical worth is needed. Even then I doubt if such men would be competent to take charge of any position before spending a year or two on some private estate.

Then we have or may have, competition from another source. I refer now to the so-called landscape gardeners, or architects, as some prefer to call themselves. To some of these, men on a high plane, with a national reputation we would all be ready to doff our hats; but there are now a vertiable flood of these embryo landscape gardeners, female as well as male, being turned loose on suffering humanity. I do not refer for a moment to the jobbing gardener or florist who has the magic words "landscape gardener" printed on his letterheads, but to the more cultured product of Amherst, Technology, and Harvard.

I have abundant opportunities to see and study these rising, active, and intelligent young men. They are being turned out in such numbers that I wonder what must become of them all. Now I have noticed that nearly all these youths and their teachers can talk pleasingly on landscape designs, but that, so far as practical *gardening* is concerned, they know very little indeed. Yet these men are intruding themselves upon those who have forgotten more of horticulture than these new fledged landscape artists know, and in not a few cases are allowed to draw plans, make changes, and suggest, or even superintend, plantings for which they are grossly unfitted. I think I am safe in saying that not one landscape gardener, architect or artist—choose whatever term you like best—in ten, is competent to draw up plans, suggest proper plantings and see such carried out.—*From an article by W. N. Craig in Gardener's Chronicle.*

MIRACULOUS WHEATS

THE notion that there is a wonderful wheat which will make the fortune of anyone who plants it seems to be almost as old as agriculture itself. In this country, at least, such an assertion was made for the so-called Jerusalem wheat as early as 1807, and, under the name of Alaska wheat, this identical variety is still being pushed upon the unwary at exorbitant prices for seed. Almost equally exaggerated claims are made for the Stoner variety, but this particular wheat has not such a long history.

Because of the many attempts that have been made by promoters to foist these wheats, under one name or another, upon the farmers of the country, the United States Department of Agriculture has made careful tests of their value. In Bulletin 357 of the department the results of these tests are said to show conclusively that neither of the wheats possesses any peculiar quality which justifies high prices for the seed. Many varieties grown commercially throughout the country have, in fact, proved to be somewhat superior to either the Alaska or the Stoner.

These facts, however, have not prevented the promoters at various times from asserting that yields of from 100 to 222½ bushels per acre can be obtained from this wheat. In particular, they have urged it as a valuable variety for the worn-out farms of the East because with such yields farmers can afford to use fertilizers. According to one circular the wheat flourishes in dry countries because its native home, Alaska, is dry; in cold countries, possibly for the same reason; and in hot countries, for some reason not stated.

A favorite story with promoters is to the effect that when the coffin of an Egyptian mummy 3,000 or 4,000 years old was opened some wheat was found in it. The seed was planted, but only a single kernel grew. This, however, was a wonderful yielder and very different from any other wheat known. This story is responsible for such names as "Mummy," wheat 3,000 years old, "Egyptian," and "Miracle." It is, of course, an absurdity, for even under the most favorable conditions seeds of wheat do not keep their vitality more than a few years.

In 1908 this wheat was brought forward again, this time not as a product of Egypt, but of Alaska. It was asserted that an Idaho farmer had found in a secluded spot of the Alaskan coast a wheat plant with a branched head. He had brought back one head, sowed its seed that fall (in 1904), obtained 7 pounds to sow in 1905, and by 1906 had 1,545 pounds, an increase of two hundred and twenty fold. From this it was argued that 1 bushel of seed per acre would produce 220 bushels. A seed grain company had obtained the seed from the farmer and would dispense it at the rate of $20 a bushel.

Upon investigation the United States Department of Agriculture found that about 700 acres of the wheat were being grown for the company in Idaho. The average yield per acre was estimated, not at 220 bushels but at 25 bushels. Upon identical conditions well-known wheat varieties of the Pacific Northwest were yielding fully as much or more and good farmers in the neighborhood were not growing the wonderful wheat.

This investigation was followed by a warning notice from the department and also by a fraud order from the Post Office Department against the advertising material circulated by the company. In spite of this fact, however, another campaign was begun in 1909 and in 1915 the wheat was actually placed on exhibition at the Panama Pacific Exposition. Last year, also, the same wheat was offered for sale at $7 a bushel under the name of Egyptian 7-headed wheat. At other times this wheat has been sold as Eldorado, Many-Headed, Many-Spiked, Multiple-Headed, Reed, Smyrna, Syrian, and Wild Goose.

NOTE *and* COMMENT

Painted Snow Flower.—It is remarkable that a plant of such singular beauty as the painted snow flower (*Spraguea Umbellata*) has so long escaped cultivation, especially when it is so easily grown, from seeds and when the roots are easily transplanted. When the winter snows of the upper Sierras commence melting, the bright green leaves of the spraguea appear, and in June it is at the height of its flowering season. Along the rocky wind swept plateaus and mountain meadows the ground is carpeted for miles with this lovely flower. The plant is low and prostrate in habit and sends up from two to five flower stems varying in height from five to eight inches. The top is surmounted with a snow white cottony ball of flowers, which are spotted with the brightest shades of delicate pink, rendering the flower one of great beauty. Its blooming period is from three to five weeks.—*S. L. Watkins.*

Four-Leaved Milkweed.—Gray says the range of the four-leaved milkweed (*Asclepias quadrifolia*) extends from North Carolina north and Chapman says it is native to the mountains of Georgia and North Carolina. I am sure its range is more extensive. I have seen it in Louisiana, Alabama and Mississippi. A prolific seed-bearer and cultivated in the gardens of New Orleans and other cities, the plant very probably has spread far and wide from self-sown seeds. It loves the shade and in its native haunts is found in woods and thickets. Under cultivation the plant grows about eighteen inches high, bearing umbels of delicate pink blossoms from

June till August. When the seeds ripen and the pods open the plant is unique and beautiful. The seeds cling to fine silky white threads and are then blown hither and yon. The common name of this pretty plant is silkweed. Seen in the woods or in city gardens, it is much admired.—*Mrs. Georgia Torrey Drennan.*

EARLY PLANT COLLECTORS.—Every age, it seems, has had its quota of objectors to the methods of those who gave names to the plants. A century ago, Schleiden, who with his friend Schwann gave the cell theory to the world wrote as follows: "Most people of the world, even the most enlightened, are still in the habit of regarding the botanist as a dealer in barbarous Latin names, as a man who gathers flowers, names them, dries them, wraps them in paper, and all of whose wisdom consists in determining and classifying this hay which he has collected with such great pains." This certainly has a familiar sound. One is inclined to wonder if another century hence there will still be room for such complaints.

COLCHICUM AND CROCUS.—Just as the first leaves begin to drift down from the trees in autumn, there spring up, in the gardens of the knowing ones, a host of crocus like blossoms that continue to appear for a month or more. These are blossoms of various species of *Crocus* and *Colchicum,* all of which pass under the general name of autumn crocuses. One would never imagine from a reading of American catalogues that there are a large number of crocuses that bloom in autumn but the fact is, that possibly half of the species in this large genus have this habit. Many kinds are cultivated on the other side of the Atlantic and the practice may well be taken up here. When once planted the species may be depended on to improve for years. They may be had in various hues of white, yellow, blue, and purple and must be planted very early in autumn if one would have blooms the first year. Very similar to the crocuses and blooming at the same time, are the various species of *Colchicum*. One species is offered by American dealers as the autumn crocus (*Colchicum autumnale*), but the plant is not a crocus. It is probably out of the question to expect people who deal in such bulbs to have any very clear idea of their botanical relationships, but the botanist should have more discrimination. As a matter of fact crocuses and colchicums belong to two entirely different families of plants. The crocuses are members of the Iridaceae and therefore have only three stamens and the ovary is inferior. Colchicums ,on the other hand, have six stamens and a superior ovary and therefore belong to the Liliaceae.

Berries of the Ranunculaceae.—Fleshy or juicy fruits are very irregularly distributed among the plant families. The Rosaceae, Solanaceae, and Ericaceae have an undue proportion of such fruits, while several of the tree groups lack them entirely and others have only an occasional specimen. It has recently been shown that practically all the juicy fruits are borne on woody plants. Here and there occur the exceptions that prove the rule, such as the strawberry, tomato, asparagus and lily-of-the-valley, but one soon gets to the end of this list. All the more surprising, therefore, is the occurrence of an herbaceous genus among the crowfoots (Ranunculaceae) which bear berries. The baneberries (*Actaea alba* and *A. rubra*) commonly known as the white and red cohosh, respectively, are said to be the only members of the Ranunculaceae in the world with this habit. The order Ranales, to which this family belongs, has many species with fleshy fruits, however, especially in such families as the Anonaceae, Menispermaceae, Berberidaceae, and Lauraceae.

Silver Thaw.—The rather poetic name of silver thaw has been given to a form of precipitation which ordinary mortals call rime or hoar frost. The word rime is reserved by the weather bureau for the feathery frost crystals that form on trees and other objects during a fog in winter. To be at their best, these crystals must be formed when there is a slight movement of the air, being built up on the windward side of objects from the supplies of moisture constantly brought to them. The silver thaw happens when the air is filled with the silvery shimmering frost crystals formed high above the earth after a cold night in winter. A scientific classification of precipitation forms include the sweating of stones and walls, dew, mist, fog, rime, hoar frost, mist ice, rain, snow, hail and sleet, but the silver thaw is the most beautiful of all both in title and appearance.

VERNACULAR NAMES.—It is very probable that many of the vernacular names cited in our manuals are not now in use in the United States except as they are learned from the manuals themselves, that is, they are book names, and undoubtedly hundreds of vernacular names in more or less common use are unrecorded. Scores of "common names" have no existence except in print, being often a mere translation of the Latin names. How much better it would be to cite an actually used vernacular name, even if known only in a limited region, than to coin a name by the simple process of translating the Latin one and thus establishing in print a name that nobody ever uses. Yet probably no herbarium in the United States gives any appreciable amount of data as to vernacular names actually in use, for the simple reason that botanists and collectors have neglected to record such names with the specimens. —*E. D. Merrill, in Science.*

A NEW FORM OF RUDBECKIA HIRTA.—In an old upland pasture at Vaughns, north of Hudson Falls, New York, where the black-eyed Susan has been very abundant for several years, an interesting form was found July 28, 1916, which may be called *Rudbeckia hirta* f. *viridiflora*. It is like the type, except that the orange-yellow rays are partly or wholly green. The type is in my collection. In some of the flowers only the lower part of the ray was green, or green along the center of the ray:

but flowers with green rays were not rare. The green rays were about half the length of the yellow rays of the ordinary flower. A green flowered yellow daisy is a very noticeable plant; as plants producing conspicuous green flowers are rather unusual in our floras. This pasture is near where this western plant was introduced about 1856. Hundreds of typical plants were in bloom in this field. Among the plants, were found occasionally, flowers with a double row of orange-yellow rays.—*Stewart H. Burnham.*

STRENGTH OF WOOD.—One of the earliest relations which foresters have established with a fair certainty is that between the specific gravity of wood and its technical qualities. Some foresters even go so far as to claim that the specific gravity of wood is an indicator of all other mechanical properties and that the strength of wood increases with the specific gravity irrespective of the species and genus. In other words the heavier the wood, all other conditions being equal, the greater its strength. Even oak, which apparently formed an exception, has been recently shown to follow the same law. If there is still some doubt that the specific gravity of wood can be made a criterion of all mechanical and technical properties of wood, the correlation between the specific gravity and the resistance to compression endwise (parallel to the grain) is apparently beyond question. The compression endwise equals 1,000 times the specific gravity minus 70. One of the other properties of wood, namely, hardness, was found to have a definite relation to the bending and compression strength of wood and this fact tempts to the conclusion that by hardness alone all other mechanical properties can be determined. Hardness was also found to have a definite relation to the proportion of the summerwood in the annual ring, and consequently to the specific gravity of the wood.—*Henry S. Graves in Journal of the Washington Academy of Sciences.*

PINK MAYAPPLE BLOSSOMS.—Like other white flowers, the may-apple or mandrake (*Podophylum peltatum*) occasionally produces a pink variety. The Garden Magazine recently recorded a form of this kind from Iowa which, in addition to being pink, is semi-double. It is interesting to note that at least one of the three other species of *Podophyllum,* all of which are natives of Asia, bears pink flowers regularly. This is *Podophyllum Emodi* from the Himalayas. It is offered for sale by several American nurserymen and is said to thrive in gardens if given a fairly moist and peaty soil.

AN EDIBLE AMARANTH.—The amaranths are rarely regarded with much favor by the gardener. A large number are pernicious weeds with no beauty of flower or foliage and the occasional species that possesses some merit of this nature, like the cock's comb (*Celosia*), globe amaranth (*Gomphrena*), and prince's feather (*Amaranthus*) are beautiful only by comparison with their congeners. Nor has this family much better claims to usefulness. Its nearest relatives, the pigweeds or goosefoots (Chenopodiaceae), on the other hand, have many useful species incuding the beet, spinach, chard, orache, quinoa and several other edible or medicinal species. Until recently, the Amarantaceae has nothing to its credit in this line, but W. E. Safford has discovered that one species once held a position of much prominence and was high in kingly favor being in fact the plant whose seeds was exacted in tribute from the Aztecs by Montezuma, himself. More than 150,000 bushels are said to have been stored annually in the royal graneries. The plant producing these highly valued seeds is no other than a form of our well-known prince's feather (*Amaranthus paniculatus*). It is a native of Mexico and was originally brought to northern gardens as an ornamental plant but is now a common weed in waste and cultivated grounds. The seeds which are ivory white and smaller than a mustard seed were ground and mixed with syrup to form a paste or dough from which images used in the religious ceremonies of the Aztecs were made. Similar plants are cultivated as grain crops in Thibet, India and Africa, and it has been suggested that this might be useful as a crop for parts of our Southwest. If it grows under cutivation as well as it does when every man's hand is against it, there should be no question regarding the success of the crop. It is likely, however, that as soon as it had a value it would develop a number of blights, rusts, and smuts like all the other pampered denizens of the garden.

LILIES WITH BULBLETS.—Early in September, when I was weeding a hardy border in which are planted Madonna lilies, I found one withered stalk which was covered for several inches above the ground with tiny lily bulbs, twenty-seven in all. Some were as large as peas; others hardly larger than pinheads. I planted them in a bulb pan and twenty-two have grown into thrifty little plants. I have never seen or heard of anything of the kind and would like to hear through the *American Botanist* if it is a common occurrence and how it is brought about.—*Adella Prescott, New Hartford, N. Y.* [This seems to be a unique performance of *Lilium candidum* but a similar production of bulbets is the regular thing in *Lilium tigrinum* and perhaps other species. The small bulblets produced among the scales of the bulb by practically all species of lily are of the same nature. Bulbs of all kinds are essentially buds. The usual form, such as is illustrated by lilies, tulips, onions, and hyacinths, become individual plants and, as in other plants, produce buds (bulbs) in the axils of the leaves. While it is usual to find these new bulblets in the axils of the bud-scales, it is not uncommon to find them on the flowering stalks of tulips and in some of the onions they occur among the flowers or occasionally entirely take their places. Again in the adder's-tongue (*Erythronium*) they form long and slender runners and in the amaryllis they often have the form of offsets. When bulbs occur in unusual places, as on the stalks without order in the case reported by Miss Prescott, they are in the nature of adventitious buds. Many plants have the faculty of thus developing new buds from growing tissues. A number of ferns, begonias, house-leeks, the common sundew and various other plants may thus originate buds on their leaves, the leaves thus taking over esentially stem-like functions. If properly handled, such buds will become strong plants. In a number of lilies, the bud-scales, themselves, if kept warm and moist will develop buds and turn into bulbs, which, since the bulb-scales are really leaf parts is not surprising. The owner of a bulb which he wishes to hurry into multiplying will often injure the base in the expectation that new buds will develop on the cut surfaces.—Ed.]

Coca.—The plant from which the alkaloid, cocaine, is obtained, (*Erythroxylon coca*) belongs to the Linaceae or flax family and is a native of Peru and Bolivia. It is a shrub some six or eight feet high. The leaves have long formed an article of trade among the natives for which purpose the shrub is extensively cultivated. The leaves are used, either infused in tea or chewed with a small quantity of powdered lime which is carried on long journeys in a small gourd. It appears to have been generally used by miners or those making long journeys without the means of securing food, as it lessens the desire for food and produces a feeling of increased energy. An immense amount of fatigue can thus be undertaken combined with a pleasureable effect. When used in moderation it seems to act as a powerful stimulant but in excess it produces a kind of intoxication of the nature of opium and the consequence of its prolonged use is quite as injurious, so that the habitues among the natives seldom live long. Dr. Spruce, the well-known South American traveller and botanist says that the native with a "chew" of coca in his mouth will often go without food for two or three days without feeling any wish to sleep.—*Botanical Journal.*

EDITORIAL

With the ending of another volume and the consequent renewal of a large number of subscriptions, we would again call attention to our "Permanent" list. Though called permanent subscribers, those on this list are under no obligation to continue subscribing for any definite length of time. The term is used simply to distinguish those friends of the magazine who subscribe year after year and who therefore form a sort of company to ensure its success. Such subscribers expect the magazine to be sent them until it is ordered stopped and they pay during the year when most convenient. The price to such subscribers is seventy-five cents a year. Any subscriber may be transferred to the permanent list by sending us $1.50 for a two-year subscription and asking to be transferred. When the subscription expires it may be renewed at the reduced rate as long as desired. Those who like the magazine well enough to wish it to continue coming to them will save money by joining the permanent list.

* * *

The replies to our request for co-operation in settling various botanical questions has been very encouraging and we forsee an interesting future for this new kind of botanizing. A short time ago, the American Genetic Association thought it worth while to try to discover where the largest American trees of their kind were located and taking a hint from this, we may well begin operations by attempting to discover some facts of a similar nature regarding our wildflowers. Replies are therefore invited to the three following questions. What is the most fragrant native wildflower in your region? What is the most beautiful native wildflower taken singly? What is the most beautiful native flower in masses? It is quite likely that replies will vary somewhat, due in part to individual preference and in part to differences in the flora. One might suppose that in New England the trailing arbutus, the Azalea and the white water lily will vie with one another for first place, but in the prairie States where heaths are often rare, the award might go to the wild crab, the basswood, or even some of the phloxes. In the South the magnolia might be chosen. As for the Far West and Northwest, there are doubtless plenty of fragrant flowers there but none seem to have become famous enough on this account to have become conspicuous. The other two questions to which replies are invited are not different forms of the same question as may at first appear. It is quite possible for flowers small and insignificant, individually, to produce much beauty in the mass while single flowers though beautiful may not always be so in groups. It may require some thought to select the representative for each question. All who are interested in the subject are invited to send in replies. There are no dues, fees or other obligations connected with the scheme. All we want is such information as readers can give and this may be sent in on a postal if more convenient. The results of the first inquiry will be published in the next number of this magazine.

* * *

As this is written both the August and November numbers are in type but not printed and the copy for the first number of the new volume is ready. The unreasonable delay in the magazine is due entirely to our printers. This, however, is to be the last delay of the kind. If our present printers do not rapidly develop more ginger we purpose changing to some other firm that is not so lacking in this essential quality.

Say what you will about the old myths and fairy tales, they pale into insignificance alongside of the modern myths invented by the inspired but ignorant reporter. Here is a new one about the "Angry Tree" which one of our readers sends us. It seems to be built up on the reputation of the sensitive plant, except that the new myth concerns a much more sensitive and ill-tempered species than ever occurried in Nature. "Did you know that a tree can get angry? There is a kind of acacia in Nevada that not only is "touchy," but, as the gardener puts it, "goes very mad." It is about eight feet high, and is a very rapid grower. When the sun sets it is ready to go to sleep, shuts its leaves together and coils up its twigs just like a pigtail. If anyone pulls that tail—well, the tree doesn't squeal, but it flutters and moves uneasily, and seems to be deeply agitated. If it is ever disturbed by a shock, such as transplanting, the leaves stand out in all directions and quiver violently. Strangest of all, they send out a pungent, nauseating odor, that is most unpleasant. It takes this bad-tempered tree an hour or two to get back into good humor." Isn't it shocking that trees in the uncivilized parts of the earth are just as wild as the other denizens of the region?

BOOKS AND WRITERS

The title of Maud Going's new book "Our Field and Forest Trees" exactly describes the contents, but no one need expect to find between its covers an account of the botanical characters of our native trees. There is not even a list of trees in the book, nor a scientific name, and yet it very entertainingly says all that may be readily said about trees as living things. A good many authors seem to think that the really significant facts about a tree are embraced in the scientific descriptions when, as a matter of fact, the technical stuff in which they so deeply delight is merely an introduction to dendrology and the things that really count with the public are the economic and ecological aspects of the subject. The author takes it for granted that her readers know the names of the trees and proceeds at once to tell about the national forests, cork and bark, midwinter forests, forest fires, the ascent of sap, and kindred topics to the extent of nineteen chapters and more than 200 pages. There are also about 60 illustrations. This is one of the books that has gotten past the "How to Know" stage and is all the better for it. It is published by A. C. McClurg & Co., Chicago, at $1.50.

Dr. William F. Ganong, Professor of Botany in Smith College, has issued a "Textbook of Botany for Colleges" from the press of the Macmillan Company, New York. This is the first of two volumes, or rather the first part of a larger volume, intended to serve as an introduction to botany for those without previous knowledge of the subject. The author's name is sufficient guarantee that the information it contains is complete and up-to-date, but the reader is likely to be impressed with the fact that the presentation is dominated by the taxonomic aspect of botany which is still so much in evidence in the Eastern States. Many pages remind one vaguely of Gray's "How Plants Grow," though this is a greatly amplified account of the subject with considerable economic and ecological matter added. Since the book is designed largely for those who wish a general acquaintance with botany, more attention is given to the larger aspects of the subject than to minute details. The sequence of the first part is leaves, stems, roots, flowers, fruits, and seeds, with a discussion of the morphology and physiology of each. The second part is to be devoted to the kinds and relationships of plants. The first part contains 390 pages and costs $2.00.

It is not likely that Prof. W. R. G. Atkins' "Some Recent Researches in Plant Physiology" will ever become popular with the general reader. It requires something of an education in both botany and chemistry before its contents become intelligible, but with this equipment it becomes an exceedingly interesting account of what has recently been done in certain lines of plant activity. Among the subjects treated are the carbohydrates of plants, pectins, osmotic pressures, the plant oxidases and their relation to color, etc. in the plant, this last being one of the most interesting chapters in the book. Although the bulk of the work is the author's own, he has carefully reported the investigations of others bearing on the subjects in hand, and a bibliography of nearly 500 titles is given. Prof. Atkins is connected with the University College, Dublin, and his book is published by Whittaker & Co., London. It is for sale on this side by the Macmillan Company at $2.40.

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